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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF LIQUID FUEL

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Our invention relates to the production of products fit for use as liquid fuel for internal combustion engines and for similar purposes. It has particular reference to a process whereby mixtures of hydrocarbons can be converted into readily volatile, low boiling and inflammable hydrocarbons of the gasoline type.

As is well known to those skilled in the art, in order to produce liquid fuel for internal combustion engines, mixtures of hydrocarbons poor in hydrogen with other hydrocarbons rich in hydrogen have been heat-treated with the result that hydrocarbons of lower boiling point were obtained.

One has also reacted carbon monoxide with hydrogen, the product being a mixture of hydrocarbons rich in hydrogen, which, being little knocking-proof, are not particularly suitable for use as liquid fuel without having previously undergone a further chemical treatment.

It has therefore been tried to subject these products rich in hydrogen, or fractions of same, to a heat treatment wherein a fuel is obtained with an octane value, (see the article by A. L. Forster in National Petrol News 23 (1931) No. 24, p. 30), not exceeding 63, the knocking-proofness of which is not satisfactory at all.

On the other hand this treatment causes considerable quantities of free hydrogen as well as hydrogen combined under the form of gaseous hydrocarbons, such as methane, ethane, ethylene etc. to be split off, which are thus lost for the production of liquid fuel.

We have now found that it is possible to produce liquid fuel having a satisfactory octane value provided that the mixtures of hydrocarbons resulting in the reaction of carbon oxides (CO or CO_2) with hydrogen or fractions of such mixtures which are particularly rich in hydrogen, are subjected together with mixtures of hydrocarbons poor in hydrogen to a suitable heat treatment.

In the practice of this process we have further found that the considerable losses in hydrogen and gaseous hydrocarbons encountered, when merely heat-treating the reaction products from the carbon oxide conversion process, which are rich in hydrogen, are greatly reduced in our process, so that a far greater yield of liquid fuel, calculated on the whole of the hydrocarbons subjected to reaction, is obtained, this fuel possessing also a considerably higher knocking-proofness.

As mixtures of hydrocarbons poor in hydrogen, we may use bituminous substances such as tars, mineral oils poor in hydrogen, emulsions of mineral or brown-coal, pitch-coal etc.

The reaction may vary between about 300 and 700° C. and operation at 400 to 650° C. under pressure above normal has been found to be particularly suitable.

We have further found that we may apply our invention with particular advantage to mixtures of the products rich in hydrogen with bituminous constituents of mineral coal or brown-coal, which are very poor in hydrogen and are separated, partly or altogether from the ashes.

The separation of the ash from the coal may for instance be effected in a well known manner by extraction of the bituminous substances or by subjecting same to a slight hydrogenation treatment, wherein the bituminous substances are liquefied at the temperatures of reaction and are thereafter separated from the ashy constituents.

A bituminous product free from ashes may for instance contain 0.1% ashes and 39.10% volatile constituents, its upper heating value being 8897 heat units/Kg., its softening temperature about 231° C.

Here also operation at a pressure above normal has been found preferable.

The process according to our invention enables us to convert a high percentage of the coal in a particularly simple manner into a high-grade fuel.

When carbonaceous materials poor in hydrogen, such as brown-coal, mineral coal, tars and the like are subjected to hydrogenation with hydrogen gas, the hydrogenation is preferably carried through in a two-stage process. In the first stage the highly viscous or liquid starting products are treated at temperatures of about 400° C. and above with hydrogen under high pressure ranging for instance between 100 and 300 atmospheres, in the presence of catalysts insensitive to the action of sulfur, such as compounds of molybdenum, tungsten and metals of the fourth, fifth and sixth groups of the periodic system, more especially the oxides, sulfides, carbonyls, phosphates and sulfates of these metals, which may be distributed on carriers such as silica gel, active carbon, pottery fragments, magnesia, alumina and the like.

We thus obtain comparatively high-boiling oils which contain hydrogen, but are not yet completely hydrogenated. In the second stage these products are then subjected to distillation in a current of hydrogen under high pressure in the presence of suitable catalysts such as mentioned

above. During this treatment the products are partly decomposed and partly combined with hydrogen to yield the desired final products.

We have further found that the products obtained in the first stage of the hydrogenation process can be reacted advantageously with the hydrocarbons obtained when reacting carbon monoxide or carbon dioxide with hydrogen for the production of valuable knocking-proof liquid fuels.

In practising our process, we subject the heavy oils resulting in the first hydrogenation stage, together with the products resulting in the reaction of hydrogen with a carbon oxide, to distillation, preferably under pressure in the presence of suitable catalysts of the kind aforesaid.

The mixtures of hydrocarbons poor in hydrogen may also be replaced by mixtures of the substances hereinbefore mentioned.

All the reactions occurring in the process according to this invention are preferably carried through in the presence of hydrogenation catalysts insensitive against sulfur poisoning, such as the sulfides of molybdenum and tungsten.

We have further found that it is possible to influence the properties of the liquid fuel obtained in the process by tuning the reaction mixtured down to a predetermined percentage of hydrogen. We are thus enabled to influence for instance the knocking-proofness and the boiling points of the products.

For instance when operating with low boiling tar oils rich in hydrogen, for instance oils boiling up to 350°C, less benzine is required than if operating with high boiling tar oil fractions poor in hydrogen or with coal containing still less hydrogen. We so choose the mixture that we obtain a final product having a predetermined percentage of hydrogen, for instance 14%, in order to obtain a final product constituting a fuel of practically the same properties. If it is desired to produce final products richer in hydrogen, we employ a larger proportion of benzines rich in hydrogen, and vice versa.

We may also add to the reaction mixtures small quantities of hydrogen gas, gas mixtures containing same or other carrier gases. We may for instance add gas mixtures rich in hydrogen and poor in nitrogen such as coke oven gas or the gaseous products rich in hydrogen which are obtained in the thermical conversion of hydrocarbons, after the valuable hydrocarbons such as acetylene have been extracted. We may also add the gas containing hydrogen which remains after separation of the ethylene and ethane and their homologues, when reacting the waste gases from the synthetical production of benzine from CO and H_2 at ordinary pressure. As a carrier gas for the carrying away of the benzine vapors resulting in the reaction, we may for instance use nitrogen gas.

In practising our invention we may for instance proceed as follows:—

Example 1

In a fractionating apparatus the mixtures of hydrocarbons resulting in the hydrogenation of oxides of carbon (CO and CO_2) are subjected to fractional distillation and the fractions passing over up to a temperature of about 110°C are retained in a condenser.

The starting mixture may contain 1 CO and 2 H_2 and is conducted for hydrogenation in contact with a cobalt catalyst, for instance cobalt metal, under ordinary pressure and at a temperature ranging between 180 and 190°C. The gases and vapors issuing from the oven are cooled down, the water formed in the reaction together with liquid hydrocarbons having the character of benzine and oil separating out. In this reaction 288 grams benzine and oil are recovered per cubic meter CO. From the gases escaping from the condenser are recovered by adsorption to active carbon low-boiling benzines of gasoline character and hydrocarbons, gaseous under normal conditions, such as propylene, propane and their higher homologues. Of gasolines may for instance be recovered 51.5 grams per cubic meter, which are constituted by about 6 grams heavy benzine and 45.5 grams light benzine, the waste gas escaping from the adsorption apparatus may contain a certain proportion of CO_2, further H_2, N_2, CO, saturated hydrocarbons and small proportions of unsaturated hydrocarbons. The end gas may for instance be constituted as follows:

	Percent
CO_2	8.8
CnHm	0.0
C_2H_4	0.0
O_2	0.3
CO	16.7
H_2	27.6
CH_4	30.0
C_2H_6	1.8
C_3H_8	0.0
N_2	14.8

The fraction passing over up to 110°C consists mainly of knocking-proof benzines containing up to 8 atoms carbon. The higher boiling fractions of the hydrocarbons, which mainly consist of hydrocarbons with 8 to 16 C atoms, are conducted into a pressure vessel, in which they are kept during a period of time which may vary between a few minutes and several hours, at a temperature of 430 to 450°C under a pressure of about 60 atmospheres, about 20% by weight tar, calculated on the weight of the reaction mixture, being added.

After the reaction has come to an end, the reaction mixture is subjected to a fractionated distillation. The residue from the distillation, boiling above about 200°C, which consists of high-boiling oils, can be treated once more in a similar manner with the products, rich in hydrogen, resulting in the hydrogenation of CO, or may be returned into the pressure vessel.

The yield, calculated on the hydrocarbons in the starting mixture or gases, will be up to 25% gaseous products, at least 50% knocking-proof liquid fuel having an octane value up to 75, the balance being heavier oils and small proportions of asphalt.

Example 2

Into a high pressure vessel is forced a mixture of 10 parts by weight finely powdered coal extract and 90 parts benzine boiling above 200°C and of 0.760 specific gravity, obtained by catalytic hydrogenation of CO and H, 5% sulfide of molybdenum being added.

The coal extract is a product merely consisting of the bituminous constituents of coal and being free from the mineral constituents of the coal, this extract being obtained by extracting coal for instance with high-boiling tar oils under the action of heat and pressure.

The temperature in the high pressure vessel is maintained at 480 to 500°C, the pressure at about 80 atmospheres. After the reaction mixture has been relieved of the pressure lasting thereon and

the gas formed and dissolved in the oil has been removed, by expansion, by suction and/or by heating to leave in the oil for instance up to 3% butane+butylene and up to 1% propane+propylene, the oil mixture, which shows a green fluorescence, is subjected to distillation. The benzine passing over below 200°C has an octane value of about 70, in contradistinction to the benzine recovered from the hydrocarbons, rich in hydrogen, produced in the hydrogenation of carbon monoxide, however without the addition of a coal extract, which only had an octane value of 63. The fractions boiling above 200°C are mixed with fresh starting material and returned in a closed cycle into the autoclave.

When the catalyst is spent, it is separated from the oil by filtration together with the non-converted parts of the coal extract and the catalyst is then treated for regeneration.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

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ALIEN PROPERTY CUSTODIAN

SEPARATOR

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This invention relates to a separator and, specifically, a separator for finely divided solid materials.

Various industries require solid materials in a finely divided state, if not in a colloidal state. Certain materialists exist naturally in this state, while others may be brought to it by grinding, condensation of vapors or the like. In all processes used to finely divide solid material, as well as in cases of natural occurrence of finely divided materials, it is necessary to separate the particles which are sufficiently fine from those which are not. Furthermore, it may be desirable to separate different substances if the original material worked in is not homogeneous. The classification in such case may be by density. One of the known processes of separation of powdered materials is based on the fact that the mass of a body is proportional to the cube of its lineal dimensions, and its cross-section is proportional to the square of such lineal dimensions.

In one process of separation of powdered materials it is sought to oppose two forces, one of which has a value dependent upon the cross-section of the body and the other dependent upon its mass. The result is that a more or less imperfect selection is effected due to the fact that the ratio of mass to section is, for a homogeneous material, dependent on the dimensions of the particles. It will be obvious, also, that particles of different densities but the same dimensions may be separated since, while the sections will be the same, the masses will be different.

Among the forces which can be thus opposed to realize selection of the above type, one may be the action of a stream of air, the other being a centrifugal force. If it is desired to select materials of successively smaller particle sizes, the mass of the particles will decrease faster than their section. The decrease in mass is proportional to the cube of the lineal dimensions and the decrease in section to the square of the same. The result is that for the minute sizes required by certain industries, the centrifugal forces in the known separator become too small and the forces due to the air flow too large to obtain an effective separation.

It is the object of the present invention to provide an apparatus for effecting separation of the above type while avoiding the difficulties inherent in the types of apparatus heretofore used. Particularly high controllable centrifugal forces may be obtained, the forces in the two cases being controllable at will and opposed in an effective fashion. Briefly stated, the apparatus comprises a rotor selector, built according to principles described below, used in conjunction with an exhauster or aspirator connected in opposition to the rotor selector and having an effect predominating over that of the rotor selector in its action as an impeller so that an air current is caused to flow radially inward through the selector.

In accordance with the invention, the selector is of an improved form to avoid the existence of critical points in the selector passages, which will determine by the position of the particle relative to them whether or not the particle will be passed or rejected by the selector. Specifically,, it is an object of the present invention to provide a selector in which throughout a substantial radial path the relation between the opposing forces acting on a particle of given size will be substantially constant. The above and other objects of the invention, relating particularly to details of construction will be apparent from the following description read in conjunction with the accompanying drawings in which:

Figure 1 is a vertical section through the improved separator taken on the plane indicated at **1—1** in Figure 2;

Figure 2 is a vertical section taken on the plane indicated at **2—2** in Figure 1;

Figure 3 is an enlarged sectional view illustrating the design of a separator rotor;

Figure 4 is an explanatory diagram illustrating the mode of operation of the improved selector as compared with that of the previous types; and

Figure 5 is a diagrammatic view of a modified form of separator constructed in accordance with the invention.

In the illustrated apparatus, the powdered material to be separated is fed from a supply, conventionally shown as a hopper **2**, through an adjustable valve **4** which regulates the flow into a conduit **6**, into which air is admitted through a nozzle **8**. While air may be forced through the nozzle, there may be provided only an induced flow of air by means of an impeller hereafter described. The nozzle in the latter case will be open to the atmosphere and in either case is used only to secure the necessary velocity to float the particles in an air stream.

The conduit **6** delivers the air carrying the floated particles through a series of tangentially arranged openings **10**, **12** and **14** into the housing **16** of the selector proper. The conduits are so arranged, as well as the tangential nozzles, so that the velocity of flow throughout the introductory passages is sufficiently high to prevent separation therein due to lowering of velocity.

Within the housing **16** and peripherally spaced from the walls as indicated at **18** to provide an annular free space, is the selector rotor comprising a plate **20** carrying passage forming members **24** defining passages **26**, the form of which will be more fully described hereafter. A second plate **28** closes off the ends of the passages opposite the plate **20** and extends adjacent the periphery of a conduit **30** projecting approximately into the center of the opening **31** within the rotor. The plate **28** carries impeller vanes **32** having

slight clearances 34 with the conduit 30 and having radial lengths substantially greater than those of the passages 26, with the result that the impeller formed by these vanes will provide greater suction than that resulting from the passage forming elements 24. As a consequence, there will be a slight circulation of air outwardly between the passages defined by the vanes 32, as indicated by the arrows in Figure 2. This automatically provides a sealing effect preventing any passage of air carrying unseparated particles between the plate 28 and an adjacent wall of the housing 16. Other sealing means such as labyrinthine packing may be used.

In order to control the flow through conduit 30, there is provided a valve 36. The material passing through the conduit 30 from the center of the selector rotor enters the intake of a second impeller 38 driven through a shaft 40 and discharging at 42. The light particles which pass through the selector rotor and are discharged at 42 may be precipitated and separated in any suitable fashion, for example, by electrical precipitation, filtration or the like. The flow may be controlled also by variation of velocity of impeller 38.

The heavier material which will not pass inwardly through the passages 26 will separate out in the annular passage 18 and may be collected in a receiver comprising an upper chamber 44, an intermediate chamber 50 and a discharge 52. Valves indicated at 46 and 48 may be provided so that with 48 closed the material collecting in 44 may be discharged into 50 by opening the valve 46, and then with 46 closed 48 may be opened to provide for discharge of chamber 50 without affecting the pressure within the housing 16, or diverting any of the air within the housing.

In the arrangement illustrated, the impeller 38 is used to produce a radially inward flow of air through the passages 26 despite the tendency of the selector rotor to act as an impeller. In other words, there are two impellers acting in opposition, and the impeller 38 prevails in its effect. The air emerging from the nozzle 8 expands just at the point where the powdered material is fed into the conduit 6 and, by reason of the expansion, aggregation of the particles after their separation and suspension by the jet is prevented. As has been pointed out above, the feeding conduit is so arranged as to maintain the air velocity sufficiently high to prevent any settling, before the air carrying the powdered material in suspension enters the rotor chamber.

In the passages 26 any particle is subjected to two forces. Since it will be taking part in a rotary motion substantially identical with that of the rotor itself, it will be subjected to a centrifugal force equal for each grain to $m\omega^2r$, in which m is the mass of the particle, ω is the angular velocity of the rotor and r is the distance of the particle from the center of rotation.

Simultaneously, each particle is subjected to centripetal force directed inwardly having a value which for practical purposes can be closely expressed as ksv^2, in which k is a constant depending on the shape of the particle, its size and the nature of its surface and which, for a material which is homogeneous, or which may be non-homogeneous but consists of particles of more or less the same size, will be substantially the same for all the particles in the mixture being separated; and in which s is the maximum section of the particle in a plane perpendicular to the air stream in relation to the particle and v is the relative velocity of the air stream and particle. It will be noted that the average velocity of the particle in a radial direction at the entrance to one of the passages 26 will be substantially zero and, under conditions such as are here involved, the radial velocity will be quite low throughout the entire passage 26 as compared with the actual velocity of the air stream. Consequently, v may be regarded as the velocity of the air stream neglecting the radial velocity of the particle.

The opposition of the forces thus obtained permits a selection either according to the size or according to the density of the particles.

In order to secure effective separation, it is obviously desirable that the two forces should act upon any particle for a maximum length of time in such fashion as to secure the same separating effect throughout that entire time. Since, in the present apparatus, the separation takes place only in the passage 26, the time of action of these forces is measured by the time it takes for the particle to pass (if it is to pass) through a passage 26. Consequently, it follows that the design should be such that if a particle is to pass through a passage 26 the forces should be such at all points of that passage as to cause it to do so; and if a particle is not to pass through the passage 26 then the forces should be such as to prevent its doing so, even though it may have entered part way into the passage. It is to be understood, of course, that the separation involves statistical considerations. In other words, particles of any given size will have a range of entering velocities (due to turbulence, etc.) extending above and below some mean velocity and consequently separation effected by any such apparatus cannot be absolutely perfect. However, with attention to considerations such as those indicated above, any particle will be subjected to conditions tending to either pass it or reject it over a maximum time with consequent improved selection.

Considering a particle which is of a size such that particles of larger size should be rejected and particles of smaller sizes passed, the two opposing forces for that particular particle should be balanced throughout the radial extent of each passage 26, or, in other words, through the passage $m\omega^2r$ should be equal to ksv^2. Since m, ω, k and s are constant, v should be proportional to $\sqrt{r}$. This means that the air velocity between the impellers of the selector should be proportional to $\sqrt{r}$; or, in other words, the decrease of the centrifugal force from the outside to the center of the selector should be balanced by an equivalent decrease in the air velocity. Since the air velocity is inversely proportional to the cross-section of the passage, the preceding condition can be realized by giving to the selector impellers such a section that the cross-section of the passage will be inversely proportional to $\sqrt{r}$.

In Figure 3 the dotted lines indicated at 54 indicate the theoretical walls for a passage 26. In order to illustrate the nature of the curves 54, they are produced inwardly to indicate that they are ultimately tangential to a circle which is of considerably less radius than the innermost radius of a practical passage. Between the limits of a practical passage 26, it will be observed that the curves 54 are substantially straight lines and, as a practical matter, taking into consideration the existence of such factors as wall resistance to flow, etc., the theoretical curved surfaces may be replaced by plane surfaces of the

type provided at 24. The foregoing design, it will be noticed, assumes the axial width of each passage 26 is constant. If that is not the case, the cross-sectional design must be made to correspond so as to remain inversely proportional to $\sqrt{r}$.

The walls of the passages should be polished to prevent sticking of any of the solid material, particularly when the material has a natural tendency to stick or become aggregated. It is to be noted that with increased accuracy or sharpness of separation, the tendency of the powder to deposit on the wall would be increased, since the end to be desired is a separation such that certain particles are in equilibrium in the passages with theoretically a zero velocity. In general, of course, such zero velocity would not tend to occur unless the friction with a wall was quite high, because smooth flow would not be attained and turbulence would maintain the particles in suspension unless they were of a sticky or aggregative nature. It is further desirable to polish the surfaces because of the Coriolis acceleration which shows that a particle between two rotating impellers and moving from the outside toward the center will have a tendency to eventually hit the preceding impeller. The setting of the impellers at an angle to the radius will not avoid this because the phenomenon is dependent upon the velocity of the particle between the impellers and, therefore, is dependent upon its size. The particles composing a powdered material are, of course, different in size, so that a design avoiding the Coriolis phenomenon for one particle would not hold for another.

It will be noticed from a consideration of the radii drawn in construction lines and indicated at 56 that, if the inner radius of the selector rotor passages is made of substantial size, the centrifugal force will, to a high degree of approximation, be constant across the cross-section of any passage 26, not differing by any more than the cosine of half the angles formed at the center by the inner ends of walls 24.

In the above, it is also assumed that the pressure differential between the outside and center of the selector is constant throughout its rotation. For this to be true it is necessary that the pressure be the same at all points of the periphery of the selector rotor because it can be assumed that the inlet pressure at the exhaustor will not be disturbed by the existence of an unsymmetrical origin. The feeding of the air and the powdered material should theoretically be made uniform all around the rotor. This effect will be substantially achieved by having a plurality of inlets symmetrically located as at 10, 12 and 14, and providing a sufficient space between the selector rotor and its casing, as well as by substantially tangential feed of the air and particles in the direction of rotation of the selector. In this way, the influence of the differences of velocity between the inflowing fluid and that entrained by the selector rotor will be negligible. Complete separation of the particles is, of course, necessary, and this may be best obtained by producing expansion of air at the point of feed of the solid material, as indicated above. It is also necessary to prevent bypassing of the selector rotor by means of a labyrinth type of joint or, as in the present case, by use of an auxiliary impeller arrangement 32 to provide a slight circulation opposing any bypass.

Reference to Figure 4 will illustrate some of the characteristics of operation of the improved device as compared with an arrangement having radially extending vanes so that the passages increase in size radially outwards. A comparison will now be made showing the characteristics of the improved separator as compared with the characteristics of this other type, which comparison will serve to illustrate the characteristics of the improved separator as compared with various other types not in accordance with the invention.

In Figure 4, the centrifugal and centripetal forces are plotted against the radial position of a particle. The values R_1 and R_2 of the radius are assumed to be the radial limits of a passage such as 26.

For a given angular velocity of the separator rotor and a given air flow condition representing, for example, some definite velocity of flow at the radius R_2, let it be assumed that the mass and cross-sectional area of a particle in equilibrium are m_0 and s_0 respectively. According to the design principles indicated above, it follows that the straight line OA will represent the variations of both $m_0\omega^2r$ and ks_0v^2 with the radius. Of course, these are opposite in sign so that the particle is in equilibrium throughout this entire straight line, and, a fortiori, between the radius limits R_1 and R_2.

Now, consider a particle having a mass m_1 greater than the mass m_0, but having the same cross-section s_0, i. e., particles of the same size but higher density. The curve representing the values of $m_1\omega^2r$ will be a straight line OB. This throughout its entire extent, will lie above the curve OA, which will still represent the value ks_0v^2. Consequently, the forces will be such as to reject this new particle throughout the entire passage 26. Attention must again be called to the fact that the distribution will be of a statistical nature, so that a particle such as the one last mentioned might well enter part way into the passage 26. However, since it will be subjected to an expelling force through the entire radial extent of the passage 26, it is extremely likely that, despite its entrance into the passage, its direction of movement will be reversed and it will be ultimately rejected. The rejection is the more certain, of course, as the mass m_1 differs from the equilibrium mass m_0.

Again let us consider a particle having the same section S_0, as the equilibrium particle, but having a smaller mass m_2 i. e., a lower density. The curve OF will represent the centrifugal force acting on this particle, while OA will still represent the force due to air flow. The curve OF lies wholly below the curve OA and accordingly, throughout the extent of the passage 26, there will be a tendency toward passage of the particle inwardly beyond the radius R_1.

Let us now consider a particle of the same density as the particle m_0, s_0 but of larger size, i. e., of both larger mass and larger section. Remembering that the mass is proportional to the cube of the lineal dimensions and the section to the square of the same, we can write, if c is the linear dimension:

$$\frac{m_0}{m_1}=\left(\frac{C_0}{C_1}\right)^3;\ \frac{C_0}{C_1}=\sqrt[3]{\frac{m_0}{m_1}}$$

$$\frac{S_0}{S_1}=\left(\frac{C_0}{C_1}\right)^2;\ \frac{C_0}{C_1}=\sqrt[2]{\frac{S_0}{S_1}}$$

$$\sqrt[2]{\frac{S_0}{S_1}}=\sqrt[3]{\frac{m_0}{m_1}};\ \frac{S_0}{S_1}=\left(\frac{m_0}{m_1}\right)^{\frac{2}{3}}$$

If the function $m_1\omega^2r$ is represented by the line OB, the function ks_1v^2 will be represented by a line OC, which, according to the above, will lie between OA and OB. Accordingly, a particle m_1, s_1 of the same density but of larger size introduced between the impellers will be subjected throughout the entire length of the passage to an ejecting force.

Similar reasoning will show that a particle of mass m_2 and section s_2 of the same density as the particle m_0, s_0 but of smaller size, will be represented by the curves OE and OF, respectively, so that a particle of such type will be carried inwards by the prevailing centripetal force throughout the radial extent of the impellers.

Summarizing, the various curves in Figure 4 represent the following in comparison with the particle m_0, s_0, which is in equilibrium and represented by the curve OA:

OA and OB—A particle of the same size and higher density.
OA and OF—A particle of the same size but lower density.
OA and OC—A particle of the same mass and lower density.
OA and OE—A particle of the same mass and higher density.
OB and OC—A particle of the same density but larger size.
OE and OF—A particle of the same density but smaller size.

As contrasted with the results obtained by the use of the improved separator described above, consideration may be given to the action of the type having ordinary radially extending vanes and, consequently, outwardly diverging passages. Consider the same equilibrium particle m_0, s_0 referred to above.

In this case, assuming radial vanes, the cross-section of the passage is proportional to the radius and the velocity is inversely proportional to the radius, so that a curve ks_0v^2 is a second degree curve such as indicated at MN. It will now be necessary to specify where the particle is at equilibrium, and let it be assumed that the equilibrium occurs at the radius R_2, namely, at the entrance end of a passage. The curve OA will still represent the value of $m_0\omega^2r$, but if equilibrium is to occur at radius R_2, the curve MN will now represent the value of ks_0v^2, as indicated above, and will intersect the line OA at T at the abscissa R_2. Between the limits R_1 and R_2 the curve MN will lie above the curve OA, which means that the centripetal force will exceed the centrifugal force. In other words, if the particle under consideration once enters within the radius R_2, it will be pulled by a continuous increasing force within the separator.

Now consider a particle having the same cross-section s_0 but a larger mass m_1, so that as before $m_1\omega^2r$ will be represented by the line OB. OB intersects MN at Q at a radial distance within the limits of the passage. Outwardly of Q the centrifugal force exceeds the centripetal force on such a particle, while inwardly of Q the reverse is true. In other words, if the initial entering velocity of this type of particle will not carry it inwardly of the point Q, it will be rejected. On the other hand, if it passes the point Q, it will be very strongly urged inwardly and will pass the separator rotor. So far as rejection of this particle is concerned, therefore, the separator passage has an effective length only that represented by the difference of the radiis of the points Q and R_2. Not only is the radial distance between R_1 and Q ineffective to reject the particle, but rather it is very effective to pass the particle.

If we consider a particle of section s_0 and mass m_2, i. e., material of the same size as m_0, s_0 but of lower density, the curve MN will still represent the force ks_0v^2. Line OF will represent the centrifugal force $m_2\omega^2r$, and it can be seen that such a particle will be passed through the selector.

A particle of the same density as m_0, s_0 but of larger size, for example, m_1, s_1, will have the curves OB and M_1, N_1 as its characteristic curves. These curves intersect at a point Q′, and it can be seen that between Q′ and R_2 the particle will be expelled, while between R′ and Q′ it will be forced inwardly. Therefore, only the part of the passage between Q′ and R_2 will be effective for the removal of undesired particles.

A particle of the same density but of smaller dimensions will be subject to forces represented by the curves OF and M_2, N_2, with the result that the centrifugal force is always smaller than the centripetal force, so that such a particle will be passed throughout the passage.

It is obvious from the above demonstration that the improved selector is far more efficient in rejecting undesirable material of either large size or high density than a selector in which the impellers have a constant thickness, with the result that the separation is much more sharply defined. In the improved selector the nature of the predominating force acting on a particle will be constant independently of the radius. In the radial vane selector, on the other hand, the selection is only effective at or near the inlet of the passages limited by the vanes.

The conditions of separation may be varied in different ways, for example, by changing the velocities of the selector and impeller rotors, by throttling flow through conduit 30 or 42, by controlling or introducing air through nozzle 8, etc.

In Figure 5 there is indicated another embodiment of the invention involving the provision of a substantially closed system which is capable of somewhat more effective control of the flow and consequently of the separation. In this figure, the separator proper is the same as that heretofore described. The conduit 30, however, provides flow into a filter chamber, indicated at 58, provided with a support 60 for filter material 62. The particles which pass the selector separate in the chamber 58 and may be removed through the valved exit 64. An admission port for air is provided at 61 and serves to permit the replacement of any air lost with the powdered material. A conduit 68 connects the filter chamber with a compressor 66 driven through a shaft 72, which compressor delivers air through conduit 70 from the jet 8, which serves for the entrainment of the powdered material. Regulation in this case may be effected by control of either the shaft 22 or 72. During normal operation there will be little flow of air through the passage 61.

WLADIMIR DE FLIGUÉ.

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BY A. P. C.

W. DE FLIGUÉ

SEPARATOR

Filed June 11, 1937

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3 Sheets-Sheet 1

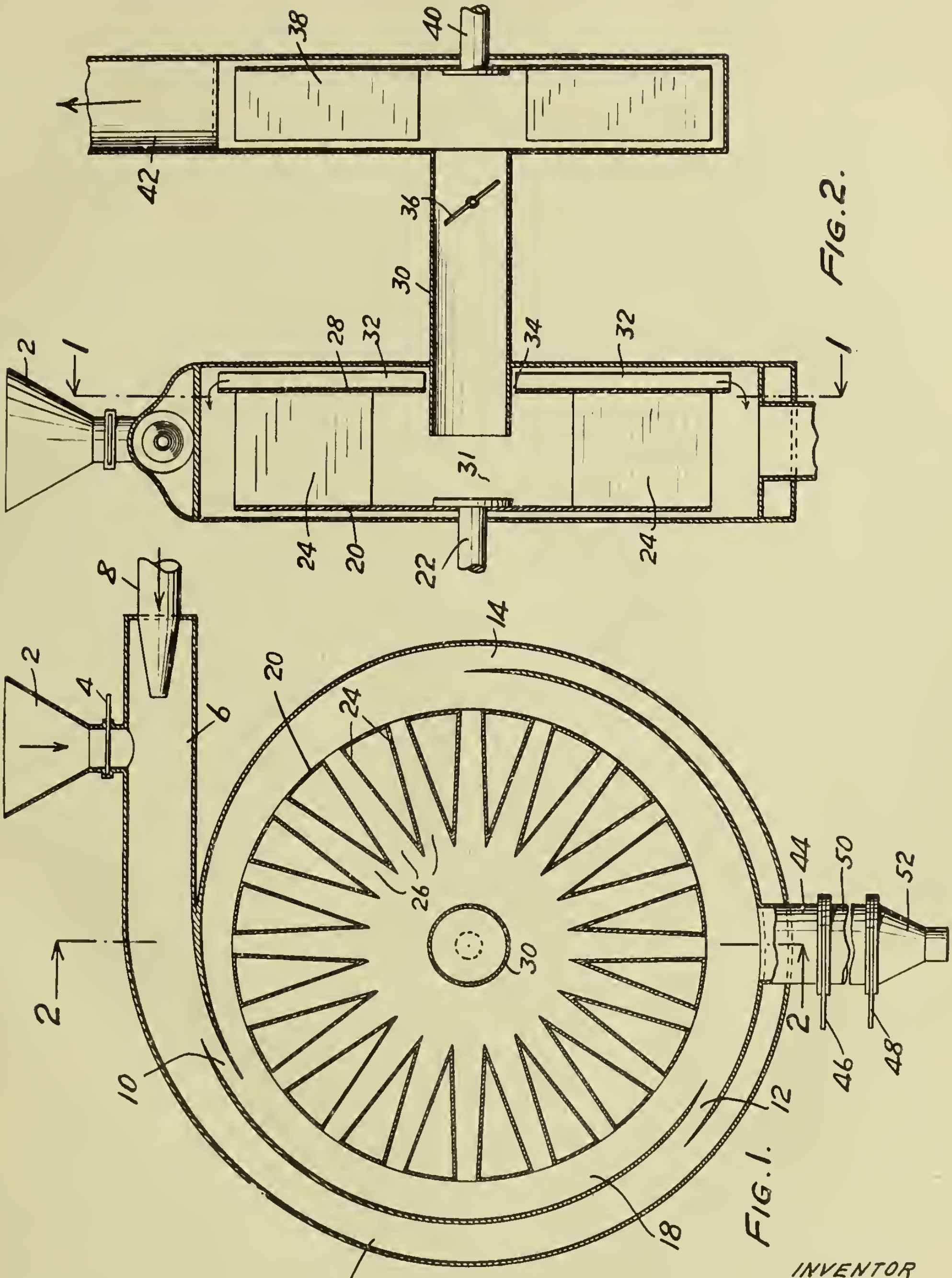

FIG. 2.

FIG. 1.

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3 Sheets-Sheet 2

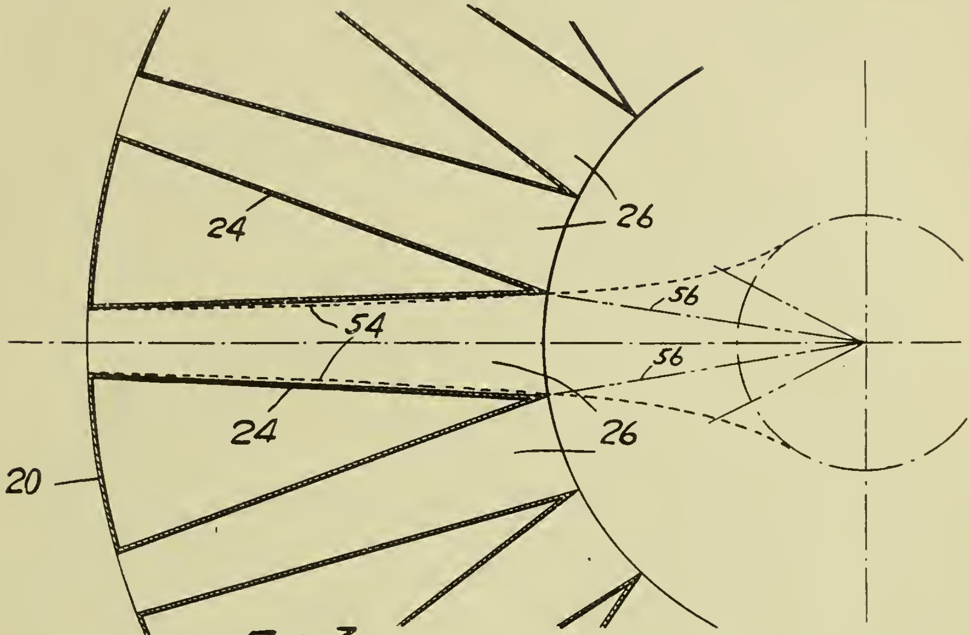

FIG. 3.

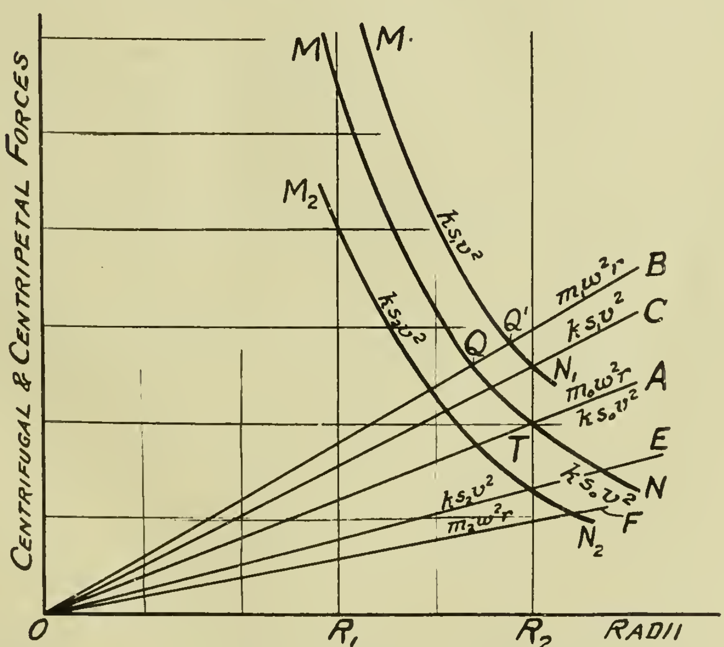

FIG. 4.

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PUBLISHED
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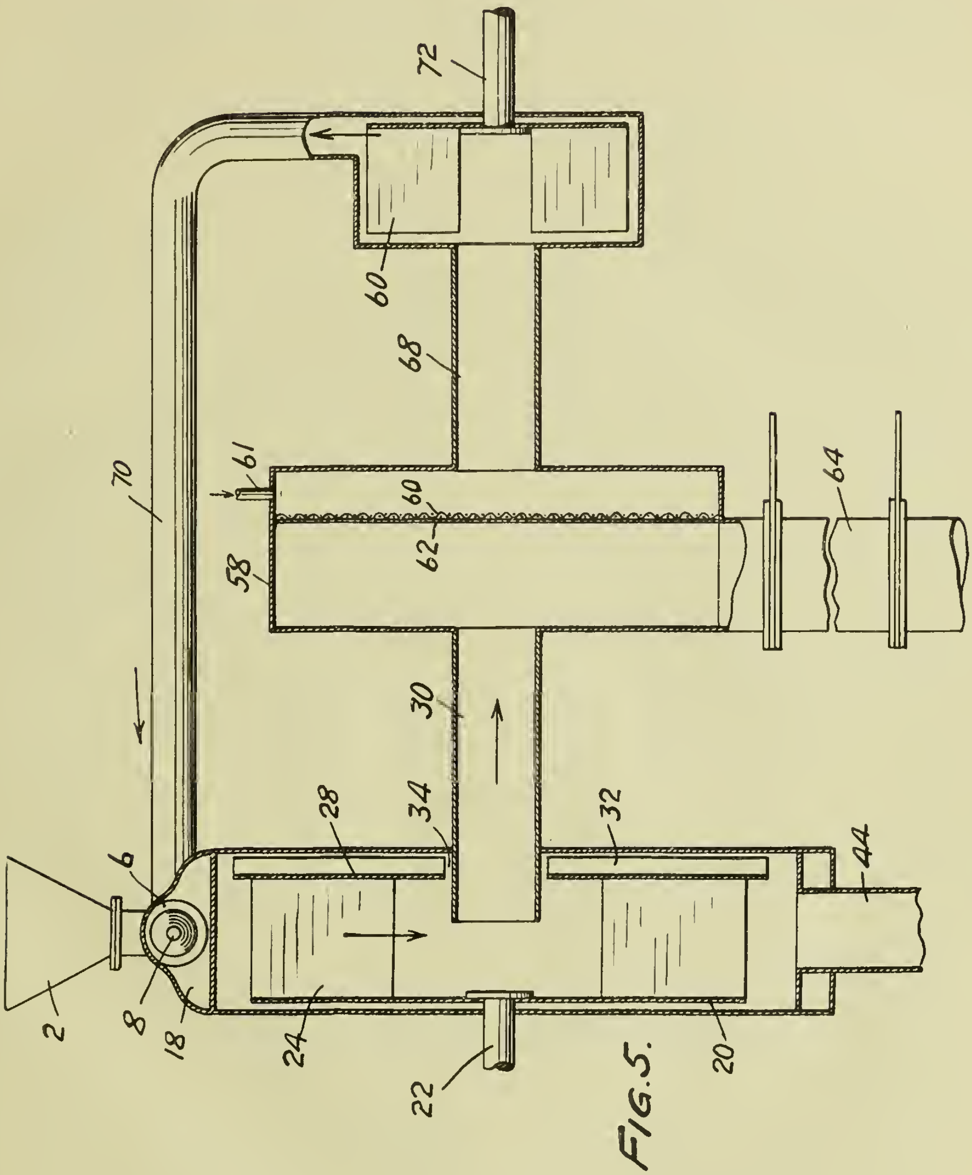

FIG. 5.

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Published July 13, 1943

Serial No. 164,337

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF SPINNING NOZZLES

Herman Holzmann, Hanau am Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 17, 1937

The invention relates to the manufacture of spinning nozzles.

The main object of the invention is to produce spinning nozzles consisting of gold-platinum alloy of high tempering hardness and great resistance to mechanical stresses and which are not so liable to close up or clog as the known nozzles.

A further object of the invention is to furnish nozzles having thinner walls and of greater durability than the nozzles known hitherto, whereby a saving is effected both in the amount of precious metals employed and the quantities of nozzles it is necessary to keep in stock as spares.

Another object is to provide a process for manufacturing such improved nozzles.

The spinning nozzles according to the invention are essentially characterised in that their platinum contents exceed 32% of the total alloy and amounts to for example, 35–60%.

For the manufacture of spinning nozzles for the artificial silk industry gold-platinum alloys have hitherto been used having a platinum content up to 30%. Alloys with 30% platinum have especially proved suitable. They have a high tempering hardness and great durability under actual working conditions, further, the tendency of the bore holes to close up in working is comparatively slight in these nozzles, but despite this an increase of the platinum content is desirable as this enables one to expect a further increase in hardness of the gold-platinum alloys in their tempered condition.

Hitherto no one has ventured to increase the platinum content of these nozzles, owing to the fact that it was anticipated that if the platinum content were raised this would result in considerably increasing the difficulties in finishing the nozzles, especially in regard to the producing of the nozzle orifices, insomuch as the quenching hardness rises proportionately with the increase in the platinum content, and hitherto the nozzles were always drilled in the quenched condition.

It is known that alloys for the purpose of tempering are quenched at a high temperature as near as possible to the lower melting point curve and then heated to a considerably lower temperature. As however it is an extremely difficult task to produce the fine orifices in the nozzles in their tempered condition owing to their great hardness, which operation has in some cases proved impossible, the drilling is carried out when they are in the quenched condition and not until the drilling is completed are they heated again for hardening purposes. For this reason it must be assumed that the increase in quenching hardness due to the increase in quenching hardness due to the increased platinum contents would render drilling impossible, as comparative tests had shown that an alloy containing 40% platnum possessed a tempering hardness of 315 Brinell units and a quenching hardness of 170 Brinell units, whereas the same figures for the gold-platinum alloy hitherto used i. e. 30% platinum and 70% gold were maximum 200 Brinell units and about 100 Brinell units at a tempering temperature of 550° centigrade.

When increasing the platinum content to 50%, the tempering hardness rises to 380 Brinell units and the quenching hardness to about 260 Brinell units.

On further increasing the platinum contents to 60% the tempering hardness amounts to approximately 420 Brinell units and the quenching hardness to about 330 Brinell units.

Increased to 65% platinum content, the alloy has a tempering hardness of 440 Brinell units and a quenching hardness of about 330 Brinell units.

It was found, however, that despite this considerable increase in quenching hardness gold-platinum alloys having a higher platinum content than 30% could be used, and that further the nozzles so produced possessed various advantages, as it was discovered that where the platinum content exceeded 32% the alloy was so exceedingly fine grained that such fine bores as are required for spinning nozzles could be produced without trouble despite their greater hardness and that these bores were even smoother walled than it was possible to make them hitherto.

Researches have shown that this fineness of grain of the gold-platinum alloys increases as the platinum content increases reaching its maximum at about 55% platinum content.

This fact having been established alloys containing more than 40% platinum are now used with advantage, e. g. such as contain about 45 to 60%. The tempering hardness of these alloys lies between about 320 or 350 to 420 Brinell units. The great quenching hardnesses of these alloys which were mentioned above strangely enough offer no obstacle to drilling the nozzles made of these alloys in the quenched condition, insomuch as has already been stated the fineness of the grain renders them comparatively easy to work.

However, the nozzles can also be drilled after a special annealing. It has been that good results are obtained when e. g. the nozzles are

drilled after an annealing at medium temperatures, i. e. from about 600 to 900° C. and thereafter heated in manner known to high temperatures, e. g. 1100 to 1240° C. then quenched and finally tempered by reheating the finished nozzles to lower temperatures, say 525–575° C. for example 550° C.

The fact is that during such annealing treatment at medium temperatures the hardness of such alloys having a higher platinum content increases only very slightly. Thus taking as an example an annealing at about 800° C. the degree of hardness of alloys having about 35 to about 65% platinum lies between only approximately 100 and 120 Brinell units.

In a practical application of this process the procedure may be as follows: the nozzles are first annealed at somewhat high temperature, say 900 to 1100° C., for example 1000° C., in order to eliminate mechanical stresses, and then the annealing temperature is reduced to that which at which temperature the drilling of the nozzles is then carried out.

It is surprising that such annealing treatment prior to the drilling should give good results, seeing that previous experience has shown that when using known spinning nozzle alloys, the orifices are rendered useless when heated to high temperatures, whereas in the present case the pre-annealed nozzles must, subsequent to the drilling, also be exposed to high temperatures of about 1150 to 1250° C. for the purpose of tempering.

However, when carrying out the present process it was found that owing to the extraordinary fineness of grain of the alloys having higher platinum contents, the nozzle orifices are not disadvantageously modified by the subsequent heating process. It is sufficient to smooth or polish the bores after the usual quenching, e. g. by means of reamer needles. In fact the quality of the orifices and bores is even better than in nozzles made from the hitherto used gold-platinum alloys.

Owing to their greater tempering hardness the spinning nozzles made according to the invention possess considerably greater resistance to mechanical stresses. The walls of the nozzles can be made thinner, thus saving precious metals. The nozzles are considerably more durable, and this characteristic makes it possible to have smaller quantities of the precious metal nozzles in stock as spares.

Owing to the greater smoothness of the bores and perhaps also due to the different composition of the alloys, the nozzles when in use show a still smaller tendency to close up in the bores than those made of the hitherto used alloy in the proportion of 70% gold to 30% platinum. The nozzles therefore do not need to be replaced very often on account of closing up of the bores or clogging. Thus stoppages and breakdowns are avoided or reduced in number, and in addition the finished products will be of greater uniformity as regards quality.

The gold-platinum alloys used according to the invention can finally contain slight quantities, e. g. 1% and up to 3% of at least one other metal of the platinum group. A percentage of rhodium has proved particularly suitable.

By means of these additional metals the alloys can be improved in various ways, and in particular these additions facilitate the work of finishing during certain manufacturing stages.

HERMANN HOLZMANN.

Published July 13, 1943

Serial No. 210,424

ALIEN PROPERTY CUSTODIAN

DECHLORINATION OF HYDROCARBON MIXTURES

Carl Clar and Paul Kühnel, Oberhausen-Holten, and Nikolaus Geiser, Duisburg-Hamborn, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 27, 1938

Our invention relates to the removal of chlorine from hydrocarbon mixtures and more particularly to the dechlorinating of the mixtures obtained in the polymerization of unsaturated hydrocarbons with the aid of polymerizing agents or condensing catalysts which contain a chlorine compound such as a metal halide.

It is an object of our invention to materially reduce in a simple and efficient manner the proportion of chlorine constituents contained in mixtures which mainly contain hydrocarbons.

It is well known that a considerable amount of chlorine, ranging between about 1000 and 3000 milligrams per litre, in the form of inorganic or organic chlorine compounds is contained in the products of polymerization which are produced, mainly in the manufacture of lubricating oils, by treating olefines or other unsaturated hydrocarbons or hydrocarbon mixtures containing such unsaturated compounds with polymerizing catalysts, such as aluminium chloride. As a rule these polymerization products are separated by distillation into a benzine fraction and a fraction which contains the lubricating oils formed. The benzine fraction separated from the other products of polymerization can be subjected to a cracking treatment for the recovery of a hydrocarbon mixture rich in unsaturated hydrocarbons. In this cracking treatment the chlorine content of the benzine has a vigorous corroding effect on the metal of the cracking apparatus.

It has already been suggested to free such polymerization products from chlorine by heating them in the presence of fuller's earth, but this treatment has been found to be practically inefficient. According to another suggestion the products of polymerization are washed with aqueous alkaline solutions in order to saponify the chlorine constituents, but this treatment is not successful either. Also when replacing the alkaline solutions by solid alkaline oxides no satisfactory removal of chlorine could be effected. Products of polymerization treated with a mixture of zinc oxide and magnesium oxide still contain 500 to 600 mgs. chlorine per litre.

We have now found that hydrocarbon mixtures can be dechlorinated to an extent which suffices for practical purposes by heating such mixtures in the presence of fuller's earth and magnesium oxide. The magnesium oxide may be wholly or partly replaced by zinc oxide.

The new process may be applied with advantage to the products of polymerization mentioned above, the products being subjected to this treatment directly after having been separated from the sludge which contains the main part of the polymerizing catalyst used. However the oily layer formed in the polymerization process may also be first subjected to a distillation and the distillates, or parts thereof, after having thus been freed from the lubricants formed, may then advantageously be treated with a mixture of fuller's earth and magnesium oxide and/or zinc oxide.

An addition of 1.5 per cent fuller's earth and 1.5 per cent magnesium oxide suffices as a rule for a satisfactory removal of the chlorine constituents. Since zinc oxide is more efficient than magnesium oxide, the 1.5 per cent magnesium oxide may be replaced by 0.6–0.8 per cent zinc oxide. If a composition of fuller's earth and magnesium oxide is used, we prefer to heat the mixture with the material to be treated to about 180° C. Lower temperatures, for instance 130–150° C., are sufficient when compositions of fuller's earth and zinc oxide are employed.

If a mixture of magnesium oxide, zinc oxide and fuller's earth is used, the temperature to be maintained during the treatment may range between about 130 and 180° C. The temperature may be the lower, the more zinc oxide is present in the mixture.

As a rule the hydrocarbon mixtures to be purified together with the additions of fuller's earth and magnesium and/or zinc oxide are heated to these temperatures during about 2 to 6 hours, whereupon the fuller's earth and the oxides are separated from the liquid constituents for instance by filtration. The hydrocarbon mixtures thus obtained only contain traces of chlorine, about 30 to 60 mgs. per litre.

If the hydrocarbon mixtures to be dechlorinated contain fractions which boil below the temperature at which the mixture shall be dechlorinated, the treatment is carried out in a closed vessel, such as an autoclave, i. e. under increased pressure.

It is another advantage of our method that the mixtures can easily be filtered in contrast to the case, where only fuller's earth is used.

Example 1

A cracking benzine which boils up to 220° C. is polymerized with aluminium chloride in the usual manner, whereupon the highly viscous hydrocarbon mixture is separated from the sludge containing the aluminium chloride contact. This hydrocarbon mixture contains benzines and lubricating oils and in addition thereto chlorinated hydrocarbons and, owing to the solubility of

small quantities of the aluminium chloride contact layer in the oily layer formed above it, small quantities of aluminium chloride double compounds. 20 litres of this impure hydrocarbon mixture, separated from the sludge, are stirred two hours together with 400 grams magnesium oxide and 200 grams fuller's earth in a closed stirring vessel at 200° C., the pressure rising to about 7.5 atmospheres above normal. The reaction mixture is then cooled to about 30° C., whereupon the content of the vessel is filtered. Filtration occurs rapidly and results in a clear filtrate, the content of chlorine of which has dropped from 2000 mgs. to 36 mgs. per litre.

Example 2

20 litres of the same impure hydrocarbon mixture as used in Example 1 and containing 2000 mgs. chlorine per litre are stirred during six hours in an autoclave at 140° C. together with 100 grams zinc oxide and 100 grams fuller's earth. The pressure rises to 4 atmospheres above normal. The mixture is cooled and filtered in the same manner as described with reference to Example 1. The filtrate contains only 47 mgs. per litre.

Example 3

A benzine recovered from the raw oil formed in the polymerization of liquid olefines to lubricating oils, by distilling the raw oil in such a manner that the lubricating oils formed in the synthesis remain as distillation residue, contains chlorine merely in form of chlorinated hydrocarbons, since the aluminium chloride double compound contained in the raw oil has a higher boiling point than the benzine distilled from the same. 560 litres of this benzine containing 1700 mgs. chlorine per litre, are heated three hours under stirring with 5.5 kgs. magnesium oxide, 2.5 kgs. zinc oxide and 5 kgs. fuller's earth in an autoclave to 160° C. The pressure rises to 6–7 atmospheres above normal. The benzine recovered from the reaction mixture by cooling and filtering has a boiling end point of 220° C. It contains only 50 mgs. chlorine per litre.

The term "polymerization" as used in this specification and the claims is intended to include also reactions which are sometimes termed condensation reactions.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

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PAUL KÜHNEL.
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Published July 13, 1943

Serial No. 224,630

ALIEN PROPERTY CUSTODIAN

ADDING MACHINE

Karl Berthold Wilhelm Kiel, Glashutte, Germany; vested in the Alien Property Custodian

Application filed August 12, 1938

This invention relates to an adding machine with which is combined a multiplying arrangement capable of operating by shortened multiplication.

It is well known that multiplying can be done on adding machines by adding repeatedly the value set up as by actuating the repeat key and pressing down the motor key repeatedly. This method of operating, however, requires keen attention on the part of the operator, and experience has demonstrated that it is not carried out without calculating errors. In order to overcome these difficulties a so-called multiplier setting mechanism has been provided on the adding machine and by means of this the "repeat" additions were carried out automatically by pressing a suitable key.

However, this did not provide means for utilizing the adding machine for large scale multiplication operations, because the adding machine, as a result of the oscillatory movements of its principal parts, was too slow in operation for the purpose intended.

It is an object of the present invention to adapt an adding machine notwithstanding its relatively slower operation for use as a multiplying machine. The multiplier setting mechanism according to the present invention is arranged so that the values above 5 are calculated by shortened multiplication.

A further object of the invention is to provide a particularly simple construction wherein a shifting member actuated by the multiplier setting mechanism acts on the stem of the motor key by means of an intermediate member such as a lever or the like.

A further object of the invention is to provide an arrangement wherein the shifting means of the multiplier setting mechanism, which determines whether addition or subtraction is to be used, is connected with the means of the adding machine for reversing the calculating mechanism gears so as to set them for the desired addition or subtraction.

The accompanying drawings show an example of the invention. Referring to the drawings:

Figure 1 is a partial side view of the invention with the cover plate removed.

Figure 1*a* is a continuation of the view shown in Figure 1 and to the right thereof.

Figure 2 is a partial plan view with a portion of the cover plate removed.

Figure 2*a* is a continuation of the view in Figure 2 and to the right thereof.

Figure 3 is a cross sectional view taken on the section line III—III of Figures 2 and 2*a* with parts broken away and omitted for greater clarity.

Figure 4 is a cross sectional view taken on the section line IV—IV of Figures 2 and 2*a* looking in the direction of the arrows and with portions omitted for greater clarity.

Figure 5 is a horizontal cross sectional view taken on the section line V—V of Figure 3 with portions omitted for greater clarity.

Figure 6 is a cross sectional view illustrating particularly the connections with the motor key and the means for securing the step-by-step return motion of the ratchet wheel.

Figure 7 is a cross sectional view of the multiplier setting mechanism in initial position.

Figure 8 is a cross sectional view similar to Figure 7 but with some of the parts omitted for greater clarity illustrating the position of the parts when the multiplier setting key "2" is depressed.

Figure 9 is a view similar to Figure 7 with parts omitted for greater clarity illustrating the position assumed by certain elements when the multiplier setting key "6" is depressed.

Figure 10 is also a view similar to Figure 7 with parts omitted for greater clarity illustrating the position taken by some of the parts when the multiplier key "0" is depressed.

Figure 11 is a view similar to Figure 7 with some of the parts omitted for greater clarity illustrating the position assumed by various elements when the multiplier setting key "9" is depressed.

Figure 12 is also a view similar to Figure 7 with parts omitted for greater clarity illustrating the position taken by some of the elements when the multiplier setting key "2" is depressed with the controls however in a different position from that shown in Figure 8.

Figure 13 is a partial cross sectional view similar to that shown in Figure 10 with parts omitted for greater clarity and other cooperating parts inserted in order to more clearly show the operation between such cooperating parts.

Figure 14 is a cross sectional view taken on the section line XIV—XIV of Figure 7 looking in the direction of the arrows and illustrating the particular controls for the multiplier setting keys "0" and "9".

Figure 15 is a similar view to Figure 14 showing the parts in a different position.

Figure 16 is a cross sectional view taken on the section line XVI—XVI of Figure 7 and looking in the direction of the arrows illustrating

particularly the control means for the reversing of the calculating or counting gears and the control for the means governing the step by step movement of the ratchet shifting means.

Figure 17 is a partial perspective view illustrating the construction of a control tube and cooperating U-shaped bars determining the step-by-step movements to be given to the ratchet shifting wheel in accordance with the particular multiplier setting key depressed, and

Figure 18 is a cross sectional view taken on section line XVIII—XVIII of Figure 15.

The invention is illustrated and described as based upon the well known "Astra" type of adding and subtracting machine, such as shown in Patent No. 1,897,932 issued Feb. 14, 1933.

The adding and subtracting machine

Arranged on the keyboard 301 of the adding machine in well known manner are the nine keys 301', which are designated "1"–"9." The zero keys 302, 303 and 304 cooperate in well known manner with the setting piece carriage 305. "R" designates the repeat key through the setting of which the well known clearing mechanism acting on the carriage is disconnected. 306 designates the clearing lever for the setting mechanism. The key 307 having the minus sign (—) sets the machine for subtraction, that is, by pressing such key, the means for reversing the calculating or counting gears is actuated and the calculating mechanism operates subtractively. 308 designates the key by which the intermediate total is determined and 309 designates the total key.

The setting piece carriage 305 is provided below and above with two rollers 420 by means of which it runs on two guide rails 421 attached to the machine frame. The carriage is provided with a plurality, in the present example ten, vertical rows of setting pins 333, each row comprising nine pins, so that the carriage of the present exemplary embodiment carries ninety such pins. The setting pins are set by means of the keys 301' or 302, 303 and 304.

Key 302 is attached to a key lever 359 which is journaled on a shaft 360 attached to the machine frame. The lever 359 is provided with a downwardly extending arm 361 with which a rod 362 is engaged. The right end of rod 362 is slidably guided longitudinally in a perpendicular bracket plate 422 attached to the machine frame. The end of rod 362 extends within range of the lowermost sliding setting pin 333, which corresponds to the "0" value. The keys 303 and 304 act in a similar manner on the rod 362.

The keys 301' are attached to the suitably formed nine key levers 423, which are also journaled on the shaft 360. Each key lever 423, except that which carries the "9" key, has a downwardly extending arm 424, each connected with a rod 425. The rods 425 are held so as to be longitudinally slidable at their free ends in the guide plate bracket 422.

The rod 425 which is connected with the key 301' designated "1," acts on the second row of sliding setting pins 333 which correspond to the value "1." The key 301' designated by "2" cooperates with the rod which is coordinated with the third row (from the bottom) of sliding setting pins 333, and so on. Keys 302 and 301' also cooperate with an escapement mechanism for the lateral movement of the carriage 305, which comprises the following construction.

The key levers which carry the corresponding keys 301' and 302 engage by their lower surfaces a rod 426, whose ends, as shown in Fig. 5 are attached to two levers 427. The levers 427 are attached to the shaft 360, which is rotatably journalled in the machine frame. One lever 427 is connected by a pin 428 to one end of a link 429 which at the other end, engages a lever 430. Lever 430 is attached to a shaft 431 rotatably journaled in a bearing 432 attached to the machine frame.

A plate 433 is also attached to shaft 431 and carries a shift tooth 433'. (See Fig. 5.) Another plate 434 is slidably mounted on plate 433. For this purpose, the two attaching screws 435 engage through corresponding slots 436 of plate 434. Plate 434 is provided with a shift tooth 437 corresponding to the shift tooth 433'. Also engaged with plate 434, at 438, is a traction spring 439 which is attached at 440 to plate 433. This spring tends to move plate 434 in the direction of the arrow in Fig. 5. According to Fig. 5, this plate is prevented from movement by its tooth 437 engaging in a rack 310 attached to the carriage.

If one of the keys 301' or 302 are depressed not only is the corresponding setting pin 333 of the vertical pin row in front of the rods 425 moved to the right from the position shown in Fig. 3, but also, at the same time, by means of the elements 426–430, the plate 433 is swung, against the traction of a spring 441, into the dotted line position of Fig. 3. In this swinging movement of the plate 433, the tooth 433' passes into the denture of rack 310, while tooth 437 is released therefrom and moves to the dotted line position of Fig. 5 through the traction of spring 439.

If the depressed key is released, then, through the traction of the spring 441, plate 433 again swings downwardly and the tooth 433' passes out of the range of the denture of rack 310 and the spring urged tooth 437 simultaneously passes into the denture of rack 310. Under the pull of the stronger traction spring 442 engaged with the carriage, the carriage is moved in the direction of the arrow in Fig. 5 for the distance of one rack tooth and the plate 434 again assumes the position shown in full lines in Fig. 5. The carriage has thereby been moved the distance between adjacent rows of pins 333 since each rack tooth corresponds thereto.

Associated with carriage 305 is a number of type carrying bars 330, of which, as shown in Figs. 2 and 5, eleven are provided arranged in adjacent relationship. It is to be noted that ten of these bars carry the types "0"–"9," while the eleventh contains the symbols or signs. The individual types 331 are arranged slidably on the bars 330. Provided at the lower end of each type bar 330 is a projecting shoulder 332 which extends within range of the setting pins 333 slidably mounted in carriage 305.

The type bars 330 are also each provided with an arm 334 over which a common cross bar 335 engages. The bar 335 is carried by a slide 336 which is moved upwardly by means of a link 337 connected thereto and by a control lever 338, connected to link 337 when the machine is operated. In this manner all the type bars 330 are released, so that they can pass upwardly under the pull of the traction springs 495 engaged with projections 494 thereon until the corresponding shoulders 332 contact the extruded setting pins 333 of the pin row coordinated therewith.

A rack 443 is associated with each type bar 330. Each rack 443 is provided with two pins

444 engaging in slots 445 of the bars 330. Each rack is provided with an arm 446 to which a traction spring 447 is engaged. The other end of spring 447 is attached to the bar 330 with which the rack 443 is associated. The spring 447 tends to move the rack 443 relative to the bar 330 in the direction of the arrow in Fig. 3.

The calculating mechanism gears and reversing means therefor

Coordinated with the racks is a calculating mechanism consisting of a suitable number of counting gear wheels 448. The gears 448 are journaled on a shaft 449, which is attached in the two parallel plates 450 and 451. The two plates are pivoted to two levers 452 by pins 453, and the levers 452 are disposed at both sides of the set of bars 330. The levers 452 are interconnected at the bottom by a crossbar 454 and are mounted oscillatably on a trunnion 455 attached to the machine frame.

Each gear 448 of the calculating mechanism is engaged with a reversing gear 456. The gears 456, which have the same number of teeth as the gears 448, are journaled on a shaft spindle 457 which is attached to the two frame plates 450 and 451. Engaged with the lower end of the plate 450, at 458, is a link 459 which is connected by a pivot pin 460 to a lever arm 461. The lever arm 461 is fixed to the shaft 352 journaled in the machine frame 316. A plate 353, which is provided at both diametrically opposite ends with pins 354 and 355 is fixed to shaft 352. By setting or pivoting plate 353 into the dotted line position of Fig. 3, the plates 450 and 451 are swung about the pins 453 so that the calculating mechanism gears 448 unmesh from and the reversing gears 456 mesh with the racks 443. In this manner a certain predetermined movement of the racks in one direction with respect to the calculating mechanism gears 448 is reversed to the opposite direction and brings about the opposite method of calculation, that is, the value based on the magnitude of the rack movement is not added, but subtracted.

The plate 353 is set in one or the other terminal position by means of a plate 356 which is provided with the two shoulders 357 and 358. Plate 356 is journaled at one end on a pin 462 provided on the end of a lever arm 463. The lever arm 463 is attached to a shaft 329 which is journaled in the machine frame 316. Also mounted on shaft 329 is a bellcrank lever 328 which is connected by a link 326 to a lever arm 324 attached to the main drive shaft 323. Through a means hereinafter described, the main shaft describes an oscillatory movement which is transmitted through the link 326 into a similar movement of the lever 463 connected to shaft 329.

A pin 464, attached to an arm 465, engages under the plate 356. Arm 465 is an extension of the key lever 466, which is journaled on shaft 360 and which carries the key 307 bearing the minus (—) sign. It is apparent that by pressing on the key 307, through the pin 464 the plate 356 is swung upwardly so that the shoulder 357 comes in front of the pin 354.

If the plate 353 was previously in the position shown by the full lines in Fig. 3, then, in the outward swinging of the lever 463, the plate 353 will be swung by the plate 356 into the dotted line position in Fig. 3 and the calculating mechanism gears 448 and 456 thus moved to the subtracting position.

The motor drive and coupling means

The keyboard 301 is also provided with the motor key 311 carried by the rod 312. The lower end of rod 312 is pivoted at 313 to a lever 314 which is fixed to shaft 315 journaled in the machine frame 316. Connected to shaft 315 is another lever arm 317 to which a rod 318 is connected. Rod 318 is connected by a pivot pin 467 to the lever 468 which actuates the clutch and contact devices. Lever 468 is journalled at 469 in the housing 319.

Attached to one end of the lever 468, with an interposed insulating member 470, is an electrical switch member 471 which cooperates with the two spring pressed contacts 472. The springs of the contacts are in the circuit of an electric motor 473, on the shaft 474 of which is attached a worm gear 475 which meshes with a worm gear 476. Worm gear 476 is attached to a vertical shaft 479 journaled in bearings 477 and 478 in the housing 319.

Attached to the shaft 479 is a ratchet tooth 480 with which the nose 482 of pawl 481 cooperates. Pawl 481 is mounted by means of the pivot pin 483 on a cam disc 484 which is freely rotatable on the shaft 479. A pressure spring 485, supported on a projection 486 on the cam disc 484 acts on the pawl 481. Cooperating with the free end of the pawl 481 is the hook end 487 of the lever 468, so that when the lever 468 assumes the position of Fig. 2*a* the hook end 487 holds the nose 482 of the pawl 481 out of engagement with the ratchet tooth 480.

Cooperating with the cam disc 484 is a cam roller 488 mounted on one arm of a double armed forked lever 489 pivoted on pin 490 provided in the housing 319. The other arm of lever 489 is pivotally connected by pin 491 to a link 492 which in turn is pivotally connected to rod 320 at one end thereof. The other end of rod 320 is pivotally connected by pin 321 to lever arm 322 fixed to main shaft 323.

Thus, if the motor key 311 is depressed, then, by means of the levers 314 and 317, the rod 318 is moved to the left as shown in Figs. 1, 1*a*, 2 and 2*a* and the lever 468 is swung in the direction of the arrow in Fig. 2*a* whereby, through the switch member 471, the circuit for the electric motor 473 is closed and at the same time the hook end 487 releases the pawl 481, so that its nose 482 engages ratchet tooth 480.

In the ensuing rotation of shaft 479 by motor 473, the cam disc 484 is carried along and through the action of the double armed lever 489, the rod 320 is at first drawn to the right from the position shown in Figs. 1, 1*a*, 2 and 2*a*, thereby rotating the main shaft 323 counter-clockwise. The spring 493 connected at one end to the frame and at the other end to rod 320 maintains roller 488 in contact with cam disc 484 and returns the rod 320 to its initial position thereby rotating shaft 323 clockwise and returning the members connected therewith.

It is to be noted that during the swinging movement of the lever arm 322 in the direction of the arrow in Fig. 1, the slide 336 is moved upwardly, so that the bars 330 are released and can pass upwardly due to the traction of the springs 495 engaging projections 494, until the projecting shoulders 332 strike against an extended sliding pin 333. In this upward movement of bars 330 the types 331 are carried into the range of the printing device, which consists substantially of the platen 339 over which the paper strip 341 coming from the roll 340 runs.

The ribbon 496 is disposed in front of the platen 339.

The calculating gears control

It is to be noted primarily that during the upward movement of the bars 330 the calculating mechanism gears 448 and 456 must not operate. On the contrary, the calculating gears are to be swung into operative position on the return of the rods 330 to the initial position. For this purpose the control means shown particularly in Fig. 4 are provided.

Fixed on a lever arm 452 is a pin 497 which cooperates with a latch 498. The latch is journaled at 499 to a frame extension arm 500 and is subjected to the action of a traction spring 501 which always tends to hold latch 498 engaged with the pin 497. The free end of latch 498 is provided with a pin 502, with which a toggle impact lever 503 cooperates. The toggle lever is pivoted at 504 to the free end of swinging lever arm 505 attached to shaft 329. In the initial position of the machine, the lever arm 505 assumes the position indicated in Fig. 4 by the full lines, and the finger-like extension 506 of the lever 503 is applied, through the pull of the engaging traction spring 507, against the pin 502. However the spring 507 is so weak that it can not overcome the action of spring 501.

Mounted on the lever 452, on which pin 497 is provided, and by means of a suitable extension, is another pin 508 over which the forked end provided on one arm of a double armed lever 509 engages. The lever 509 is journaled by means of the pin 510 on the machine frame 316. The free end of lever 509 is provided with a pin 511 which extends into the movement range of the toggle impact lever 503 carried by lever arm 505.

If, by actuating the motor key, the main shaft 323 is rotated counter-clockwise, then, at the same time, by means of the link 326, the shaft 329 is rotated counter-clockwise and the lever arm 505 is swung out in the direction of the arrow in Fig. 4. In this swinging movement, the lower shoulder of the toggle lever 503 strikes against the pin 502 and the latch 498 describes a swinging movement in the direction of the arrow in Fig. 4. Through this swinging movement, the pin 497 is released from the latch catch so that the levers 452 together with the calculating mechanism gears 448 and 456 can swing through the traction of spring 512 to the right as shown in Fig. 4, so that the gears of the calculating mechanism can move outside the range of the racks 443. After the lever 503 has passed over the pin 502, the latch 498 is again drawn into the operative position, wherein the end of latch 498 is applied on the pin 497. Thus, immediately after the beginning of the upward movement of the bars 330, the calculating mechanism gears are swung into the inoperative position.

When the lever arm 322 reaches its extreme right end position, the lever arm 505 assumes the dotted line position of Fig. 4, in which position the finger-like extension 506 is applied against the pin 511 of the double armed lever 509 which is in the dotted line position of Fig. 4 corresponding to the swung out position of the levers 452. At the beginning of the reverse or return rotation of the shaft 329, and therefore before the downward movement of the bars 330, the upper shoulder of the toggle impact lever 503 strikes against the pin 511 and the double armed lever 509 is swung back into the position shown in full lines in Fig. 4.

In this swinging movement of the lever 509, pin 508 moves the levers 452 back to the initial position shown in full lines in Fig. 4. As soon as this initial position is reached, the latch 498 can again, due to the action of spring 501, lock the pin 497. This means, however, that while the bars 330 have been carried downwardly towards the initial position, the calculating mechanism gears 448 and 456 are in the position shown in Fig. 4 and in Fig. 3. While the bars 330 are moved downwardly, the calculating mechanism gears are shifted positively or negatively, according to whether the plate 353 has thrown gears 456 into mesh with racks 443 or not.

The printing mechanism

The printing mechanism which enters into operation when lever arm 505 assumes the dotted line position of Fig. 4 operates in the following manner.

It is first to be noted that the pin-like intermediate members 343, shown in Fig. 1, are opposite the ribbon 496. The hammer levers 345, mounted oscillatably on the common shaft 346, cooperate with the pin-like intermediate members, which are guided axially slidable in the support 344 and are held by the springs 343′ in the position shown in Fig. 1. The hammer levers 345 are subjected to the action of springs (not shown) which tend to swing them in the direction of the arrow shown in Fig. 1. The tensioning of the levers 345 is provided by the crossbar 347 which is attached to a lever 348. The latter is connected with a lever arm 349 in the slotted end 350 of which a pin 351 on one arm of the bellcrank lever 328 engages. The hammer levers are provided with the well known checks, stop or the like which, when the machine is actuated, and assuming that it is set for printing, are released, so that, under the pull of the springs engaged therewith the hammer levers contact the reinforced ends of the intermediate members 343 and move these so that they strike the type in front of them against the paper 341 with the ribbon 496 interposed.

The above well known arrangements, which serve for addition and subtraction, are coordinated with a multiplier setting mechanism, described hereinafter and by means of which shortened multiplication is possible.

The multiplier setting mechanism

The parts belonging directly to the multiplier setting mechanism are mounted on the base plate 103, which is attached by screws 363 and 364 to the machine frame 316 of the adding machine. The multiplier setting mechanism has ten multiplier setting keys 97 bearing the indicia "0"–"9" which are disposed at the right of the keyboard 301 of the adding machine.

Each of the keys 97 is mounted on a slide 98 (Figs. 7 and 11). The upper ends of the slides 98 are guided in slots 99 provided in a plate 100, while the lower ends are guided in corresponding slots of a plate 101. The latter is attached by cross members 102 to the upper plate 100.

The cross members 102 are fixed to the frame wall 103 by means of the screws 104. Encircling the lower end of the slides 98 are the springs 105 which urge the cross extensions 106 on the slides 98 against the lower side of the plate 100 and thus tend to hold the slides in the initial position.

The main shaft oscillation control

Disposed longitudinally slidable between the two rows of slides 98 is a rectangular tube 107

which is guided in suitable recesses 108 provided in the cross members 102. Attached to tube 107 is a bearing eye 109 which extends downwardly through a longitudinal slot provided in the plate 101. Journaled in the eye 109 by means of the pivot pin 110 is a pawl 111 with which a spring 112 engages and which tends to force the pawl upwardly. In the initial position shown in Fig. 7 the nose 113 of the pawl 111 is applied against the end 114 of the slot 115 provided in the plate 101. A traction spring 117 engages at one end the pin 116 provided on tube 107 and at the other end is attached to the front cross member 102. This spring urges tube 107 to the left as shown in Fig. 7. In the initial position shown in Fig. 7 the tube is locked by the pawl nose 113.

Tube 107 is provided on both sides with window-like recesses 118 (see Fig. 17) which connect with recesses 119 provided on the upper side of the tube. When the tube 107 is in the initial position, these recesses 119 are positioned exactly under the cross extensions 106 of the slides 98. It is to be noted that the recesses 119 are substantially only as wide as the thickness of the slides 98. Also, the window-like recesses 118 are so arranged with relation to the recesses 119 that, when the cross extensions 106 of the slides have entered the recesses 118 due to pressure on the keys, and the pawl 111 is released, the tube 107 may move for graduated lengths corresponding to the particular number value. Thus, the recess 118 coordinated with the "0" key permits movement of the tube for the distance x, the recess coordinated with the "1" key for the distance $2x$, and the recess coordinated with the "4" key permits a movement of the distance $5x$, etc. It is the same with the keys "5"–"9", but therein the movement corresponds to the complementary value. The recess coordinated with the "5" key thus permits a movement of the distance $5x$ and the recess coordinated with the "9" key permits a movement of the distance x.

A rack 119 is attached to the square tube 107 and engages gear 120. Gear 120 is mounted on pivot 120′ on the base plate 103 and is connected to a ratchet shifting wheel 121. A one tooth shift or rotation of the wheel 121 will cause a movement of the rack 119 and consequently of the tube 107 for a distance x.

Associated with the lower ends of slides 98 are the two bars 122 and 123 which are carried link-parallelogram-like by the two members 125 journaled by pivots 124 to the bottom of the plate 101. Angular bars 127 and 128 (see Figs. 7 and 9) are pivoted at 126 to the ends of the bars 122 and 123. The bar 127 is provided with a slot 129 in which a pin 131 provided on a lever 130 engages. Lever 130 is oscillatably journaled on a pin 132 attached to the frame wall 103. The other bar 128 (see Fig. 11) is provided with a slot 133 into which a pin 134 extends. Pin 134 is attached to the lever 135 which is likewise journaled on pin 132.

Extending into the path of movement of bars 122 and 123 (see Fig. 9) is a pin 141 which is attached to a lever 142 pivoted at its front end to the frame 103. A traction spring 144 (see Figs. 7 and 8) is engaged at 143 with the lever 142, and the spring 144 tends to hold the lever 142 in the position shown in Fig. 7. Journaled on the lever 142, at 145, is a pawl 146 having a projecting shoulder 147 which engages a shoulder 148 provided on the pawl 111. A spring 150 engages the pin 149 on the pawl 146 and tends to apply the pin 151 on the pawl 146 against the upper edge of the lever 142.

Cooperating with ratchet shifting wheel 121 is a plate 152 which is journaled oscillatably by pin 153 on the base plate 103.

Plate 152 is provided with a pawl 154 which is retained in the initial position shown in Figs. 1 and 7 by the locking extension 155, which extends into a recess provided in the pawl 154 of the plate 152. The locking extension is provided on the end of one arm of a double armed lever 157 which is oscillatably journalled by the pin 158 in the wall 103.

Journalled at the free end of the other arm of lever 157 by the pin 159, is a second lever 160 with which is engaged one end of a torsion spring 161 which, at the other end, is supported by a pin 387. Engaged with the lever 157, as shown, is the traction spring 163, which tends to hold the locking extension 155 in engagement with pawl 154. By means of the torsion spring 161, lever 160 is given a tendency to swing counterclockwise about pin 159. A lateral projection 164 provided at one end of the lever 160 is applied, in this manner, against the corresponding projecting pivot pin 110.

Plate 152 is subjected to the action of a traction spring 165 which tends to turn the plate clockwise. The spring 165 is connected to an arm 166 of the plate 152, and the arm 166 has a pin 167 connected to a bar 168 (Figs. 1 and 8). For this purpose the pin 167 engages through a slot 169 of the plate 103. Bar 168 is provided with a longitudinal slot 170 into which extends a pin 171 attached to the wall 103 (Fig. 8). The left end 370 of the bar 168 extends within range of a pin 371 (Fig. 1) which is on a lever plate 372. The latter is journalled by a pin 373 to the frame of the adding machine and provided with an extended finger 374 which engages over a pin 375 provided on the rod 312 of the motor key 311.

The pin 387 serving as a support for the spring 161 extends into the plane of movement of the angularly bent end of the lever 160. The pin 387 is attached to the end of a double armed lever 388 (Fig. 1) which is journalled by pin 398 on the frame plate 103. Lever 388 has a cam-like end 390 extending into the range of movement of a lever 207.

Pivoted to the frame plate 103, at pivot 391, (Fig. 6) is a V-shaped plate 392 to which, at 393, there is secured a traction spring 394 which tends to swing the plate in the direction of the arrow in Fig. 6. One end 395 of the plate 392 extends within range of a pin 396 provided on a pawl 214. The other free end 397 of the plate 392 extends into the range of movement of a pin 398 which is attached to one end of the bellcrank lever 399, which is carried by the main shaft 323 of the adding machine and in every oscillation swings from the initial position shown in Fig. 6 to the direction of the arrow and back.

The step by step actuation of ratchet wheel

Attached to shaft 323 is also a lever 400 at the free end of which, at pivot 401, there is secured a connecting rod 402 which is pivoted at the other end on the pin 403. Pin 403 is attached to a lever 405 which is oscillatably journalled by pin 406 on the plate 103. Provided also at the end of lever 405 is a pin 407 which engages through a corresponding slot of the supporting plate and extends within range of an arm 177 provided on a slide 174. The latter is longitudinally slidable

on plate 103 and for this purpose is provided with longitudinal slots 175 through which the screws 176 attached to the wall 103 project. Journalled on the bar 174 by pin 179 is a lever-like plate 180, at one end of which, at 181, there engages a traction spring 182 and the other end of the spring is attached, at 183, to the bar 174. The lever-like plate 180 is provided with a rectangular bent extension 184 which extends through a recess 185 provided in plate 103 within range of ratchet shifting wheel 121 (see Figs. 6 and 13).

Plate 174 is provided with a downwardly extending projection 186 (see Figs. 6 and 13) cooperating with the projection 187 of a sliding plate 188. The sliding plate is longitudinally guided by means of two slots 189 provided therein through which extend two pins 190 attached to the plate 103. The traction spring 191 engaged with plate 188 tends to move the plate to the right as shown in Fig. 6. Provided on the plate 188 is a pin 192 which extends into the plane of an abutting surface 193 provided on lever 180.

Pivoted to bar 133 by pin 215 is the pawl 214, with which the torsion spring 216 engages and which tends to apply the angular projection 217 of pawl 214 against the upper edge of the bar 133. (Figs. 6 and 8).

The carriage shift control

Coordinated with bar 168 is a sliding plate 365 which is provided with longitudinal slots 367 and 368. Engaging through the slot 367 is the screw pin 366 attached to the plate 103. Engaging through the other slot 368 is the pin 206, which is attached to a lever 207 and the lever 207 is journalled on a pin 208 attached to plate 103. The sliding plate 365 is provided with a shoulder-like projection 369 which cooperates with the correspondingly formed projection 395 of the pawl 214.

Means for aligning and disaligning recesses

Considering the case in which, through shortened multiplication in the immediately preceding decimal position, the next decimal position is greater by the value "1" than the value of the number, two U-shaped bars 227 and 228 are longitudinally slidably positioned (see Fig. 17) in the tube 107. These bars have recesses 229 corresponding to the recesses 118 in tube 107. Attached to each bar is a pin 230 (Fig. 7) which extends through a slot 231 provided in each side wall of the tube 107. Engaged with each pin is a traction spring 232, fastened at the other end, at 233, to the tube 107. The springs 232 thus tend to move the U-shaped bars 227 and 228 relative to the tube 107, in such direction that the pins 230 are applied against the right ends of the slots 231. In this positon of the bars 227 and 228 relative to the tube 107, the operative edges of the recesses 118 are in operative relation to the window-like recesses 229 of the bars 227 and 228. These latter, however, as explained hereinafter, can, also, alternatively assume another position in which the corresponding edges of the window-like recesses 229 project forwardly of the edges of the window-like recesses 118, for a certain distance. This distance corresponds to the precedingly mentioned distance x, which at the same time represents a one step movement of the ratchet shifting wheel 121.

This alternative position is produced by a double armed lever 234 journalled on bar 227 by means of the screw pin 235 while the lever 237 is likewise rotatably attached by a screw pin 235 to the bar 228. The levers 234 and 237 are provided with hook-shaped projections 238 which alternately engage with corresponding recesses 239 provided on the tube 107. In the initial position according to Figs. 1 and 7 the hook-shaped projection 238 of the lever 234 lies in the coordinated recess 239, while the lever 237 is swung out so that its hook-shaped projection 238 is raised out of the range of its cooperating recess 239.

Setting control

The levers 234 and 237 are provided with extensions 240 which extend obliquely downwardly and into the range of the pin-like abutments 241 and 242. The abutment 241 is attached to the angular extension of a bar 243, while the abutment 242 is attached to the angular extension of a bar 244 (see Fig. 9). Bars 243 and 244 are vertically slidable on a plate 245 attached at right angles to the plate 103. For this purpose, screws 246 attached to bars 243 and 244 engage through slots 247 provided in plate 245. See Fig. 16. Journalled between the two bars 243 and 244, at pivot 249, is a double armed lever 248 having the pins 250 which engage the bars 243 and 244. The pins 250 project through the elongated recesses 251 provided in the plate 245. By means of this lever 248 the two bars 243 and 244 are positively interconnected so that when the one is moved downwardly the other is moved upwardly correspondingly. Lever 248 is held inoperative at both end positions. For this purpose, the pointed end 252 of the lever 248 cooperates with a gable-shaped extension 253 provided on a lever 254. The lever 254 is journalled by pin 255 on the plate 245 and is subjected to the traction of a spring 256.

Each bar 243 and 244 is provided with a recess 257. Extending into the recess 257 of the bar 243 is one arm 258 of a bellcrank lever having another arm 259. The bellcrank lever 258, 259 is connected with the lever 130 (Fig. 11). Engaging in the recess 257 of the bar 244 is an arm 260 of a similar bellcrank lever having another arm 261 and the bellcrank lever is connected to the lever 135.

As the lower ends of the key slides 98 extend into the range of the bars 122 and 123, on pressing a key 97 the lower end of the corresponding key slide contacts with the bar 122 or 123 and carries it into the position shown in Fig. 10 or Fig. 11. This causes the lever 142 to be swung downwardly and through the action of the pawls 146 and 111 releases the lock of the tube 107 and such tube can snap into a position determined by the particular cross extension 106.

Means for securing one decimal advance

Since, in certain cases, on pressing the key "0" and the key "9" (such as when on pressing the "0" key, shortened multiplication is not used in computing the preceding decimal position, and on pressing the "9" key shortened multiplication is used relative to the preceding decimal position) an advance is to be made for one decimal position, the following arrangement is provided.

The bars 122 and 23 (see also Figs. 15 and 18) are provided, in the range of the slides carrying the "0" and "9" keys, with bent portions 262, so that the key slides can pass by the bars 122 and 123 freely. Disposed in the range of these two key slides for the keys "0" and "9" are the double armed levers 263 and 264 (see also Fig. 14).

These two levers are journalled by means of pins 265 on a plate 266 which is journalled by means of a pin 267 on a sliding plate 268. The two end positions of the plate 266 are determined by a pin 269 mounted on the sliding plate 268 and this pin 269 extends into a rectangular recess 270 of the plate 266.

The sliding plate 268 is vertically slidable on a plate 272 attached by screws 271 to the plate 101 (see also Figs. 7, 13). For this purpose, the screws 273 attached to sliding plate 268 extend through corresponding slot-like recesses 274 provided in plate 272. Extending also through the lower guide slot 274 is the pin 275 attached to the slide 268, with which pin 275 there is engaged a traction spring 276 which is attached at the other end to the pin 277 provided on the plate 272. As shown on Figs. 7 and 14, the extension 279 on the lever 278 engages under the sliding plate 268. The lever 278 is connected with the above-mentioned lever arm 207 journalled on pivot 208.

Connecting the free lower ends of the levers 263 and 264 is the common traction spring 307 which tends to apply the pins 280 attached to said levers against the lower edge of plate 266 (see Fig. 15). The upper ends of levers 263 and 264 are provided with shoulders 281 which extend alternately within the range of the key slides coordinated therewith. In the position shown in Fig. 14, which corresponds to the initial position according to Figs. 1 and 7, the shoulder 281 of the lever 263 is in the range of the key slide 98 carrying the "0" key.

Provided on each of the bars 122 and 123 is a downwardly extending arm 291 (see Figs. 7 and 10) to which a double armed lever 293 is pivoted by means of the pin 292. These levers 293 are provided at their upper ends with tongue-like extensions 294 and the bent portions 282 of bars 122 and 123 are slotted in the range of such extensions (see Figs. 10 and 11). Engaged with each lever 293 is a traction spring 295 attached at the other end, at 296, to the bar 122 or 123 and which tends to draw the tongue-like extension out of the range of the coordinated key slide and apply the upper end of the lever 293 against an abutting pin 297 provided on each bar.

The lower free end of each lever 293 is provided with a pin 298. These pins 298 extend into slots 299 provided at the ends of the two bars 300. These two bars are connected at their other ends by pins 301 with the arms 259 or 261 of the bellcrank levers cooperating with recesses 257. By means of these bars 300 and the members 257 to 261, 243, 244 and 248, the levers 293 are so interconnected that only the tongue-like extension 294 of one lever 293 will always extend into the range of its cooperating key slide. In the initial position of Fig. 1 the tongue-like extension 294 coordinated with the key "0" would thus be carried out of range of the corresponding key slide, while the other tongue-like extension 294 extends in the range of the corresponding key slide of the key "9."

Pivoted on the pin 206 of lever arm 207 is a control bar 376 (Fig. 1) which, at the other end, is connected by a pin 377 with a lever arm 378. The latter is mounted freely rotatable on a shaft 380 journalled in a frame extension 379. Attached to the shaft 380 is a plate 381 which is engaged by a traction spring 382 attached at the other end, to pin 383, on the lever 378. This traction spring tends to apply the shoulder 384 of the plate 381 against the pin 383. A lever arm 385 is also attached on the shaft 380 and has a pin 386 extending into the plane of the extension 361 provided on the key lever 359.

Control of reversing mechanism

The reversing or shifting of the calculating mechanism, that is, its positive or negative, or additive or subtractive, connection with the rods 330, is initiated by the two slides 243 and 244 arranged on the wall 245 connected to the plate 103. These slides are controlled by the bellcrank arms 258 and 260. For this purpose, there is coordinated with the slides 243 and 244, a setting plate 408 (Fig. 16) which is pivoted by means of the pin 409 to the double armed lever 410. Lever 410 is journalled on the pivot pin 411 secured to plate 412 which is connected to plate 103.

The setting plate 408 is provided with two slot-like recesses 413 and 414 which open into two V-shaped openings. The pins 250 on the slides 243 and 244 are so constructed that they project with their ends into the range of movement of plate 408. If the plate 408 is in the position shown in Fig. 16, the coordinated pin 250 has passed into the recess 413. Inasmuch as the rods 243 and 244 are still in the initial position, lever 410 is in the position shown in Fig. 16. The end of a lever 416 (see also Fig. 1*a*) journalled at 415 on the machine frame contacts the free end of lever 410. Attached to lever 416, by rivets or the like 417, is an arm 418 having a bent end 419 which engages under the setting plate 356.

If, now, the slides 243 and 244 are shifted from the initial position according to Fig. 16, which takes place for example when one of the keys "5"—"9" is depressed, the slide 243 is moved downwardly and the slide 244 upwardly, and at the same time lever 410 is swung by the plate 408 so that the lever 410 causes the lever 416 to swing out in the direction of the arrow in Fig. 1*a*, that is, raises. The setting plate 356 is thereby raised to such extent that its shoulder 357 passes into the range of the pin 354.

If minus multiplications are desired it is only necessary, by means of the handle 420, to swing the plate 408 into the other end position, in which the pin 250 coordinated with the recess 414 is engaged. The handle 420 (Figs. 2 and 16) is mounted on a lever 421 journalled on pivot 422 on the frame bracket 289 and the forked end 423 of lever 421 engages the correspondingly reduced end 424 of the plate 408.

The operation

The operation is explained with reference to a calculating example:

12738×26092

The multiplicand 12738 is first set up on the keyboard 301, beginning with the highest decade, thus the "1", then the "2", the "7", then the "3" and finally the "8", by depressing the corresponding keys 301′. Then, after the repeat key "R" has been actuated, beginning with the lowest digit, the multiplier is set up in the multiplier setting mechanism keys 97. The key designated "2" in the two key banks carried in plate 100 is next depressed.

By depressing key "2", the parts are carried into the position of Fig. 8 by contact of the slide 98 on the bar 122. Bar 122 contacts pin 141 and lever 142 is swung downwardly which, through the pawl 147, carries pawl 111 into the release position. The tube 107 is now moved by the spring 117 as far to the left as the cross exten-

the tube 107 can move to such an extent that the shifting wheel 121 may describe four shift steps to bring pin 287 into action.

It is also to be noted that, by pressing on the bar 123 and actuating the bar 128, the levers 135 and 130 are carried into the position of Fig. 9. This causes the lever 410 to be shifted into the dotted line position of Fig. 16 through the action of the setting members 243 and 244. The setting plate 356 is thus swung by the arm 418 into the upper position in which its shoulder 357 comes in front of the pin 354.

In the consequent four oscillations of the main shaft 323 (corresponding to the four shifts of the wheel 121) the multiplicand 12738 is subtracted four times at the corresponding decimal position by the calculating mechanism gears 448 and 456. During the fourth oscillation of the shaft 323 the shifting wheel reaches its initial position as shown in Fig. 7 and the shift bar 168 is again moved to the right into its initial position. This, in turn, results in the disconnection of the electric motor 473 and the clutch 480, 482. In the return of bar 168, the carriage 305 is shifted a step by means of the pawl 214 and the plate 365.

Entry of fifth decimal position of multiplier

If, now, the multiplier key 97 marked "2" is pressed for the fifth decimal position of the multiplier, the position shown in Fig. 12 is assumed. As the pawl 234 coordinated with bar 227 is in the raised position, tube 107, in contrast to the position according to Fig. 8, can move to the left for three shift steps. The main shaft will, therefore, describe three oscillations before the bar 168 is moved to the right and the lever 372 is swung to disconnect the motor 473 and the coupling 480, 482. As the bar 127 is carried downwardly on depressing the multiplier key 97 marked "2," the levers 130 and 135 are shifted so that the lever 410 again assumes the position shown in Fig. 16 in full lines. Arm 418 thus releases the setting plate 356, so that its shoulder 358 can come in front of pin 355. In the first rotary movement of main shaft 323 the calculating mechanism gears 448, 456 are carried into the plus or positive position, so that during the three oscillations of shaft 323 the multiplicand is carried three times into the corresponding next highest decimal position, positively.

The calculation is then terminated and the calculating mechanism contains the result

332,359,896

By actuating the keys 308 or 309 this result can be transferred to the type bars and printed on the strip 341.

The adding machine has thus done the following: first, the multiplicand 12738 was carried twice, positively, into the calculating mechanism. After a shift advance of the carriage 305 into the next higher decimal position the multiplicand was introduced once into the calculating mechanism subtractively. After a further shift movement of the carriage into the next higher decimal position the multiplicand was transferred positively into the calculating mechanism. This done, the carriage made a further shift movement into the next higher decimal position, in which the multiplicand was then introduced four times into the calculating mechanism. Finally, after another shift movement of carriage 305 into the next higher decimal position the multiplicand was added three times in the calculating mechanism. The calculation was thereby terminated and it was completed with eleven oscillations of the main shaft 323.

It is to be understood that the invention above described is not limited to "Astra" machines and may be embodied in other makes of adding machines and is capable of various modifications.

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PUBLISHED

JULY 13, 1943.

BY A. P. C.

K. B. W. KIEL

ADDING MACHINE

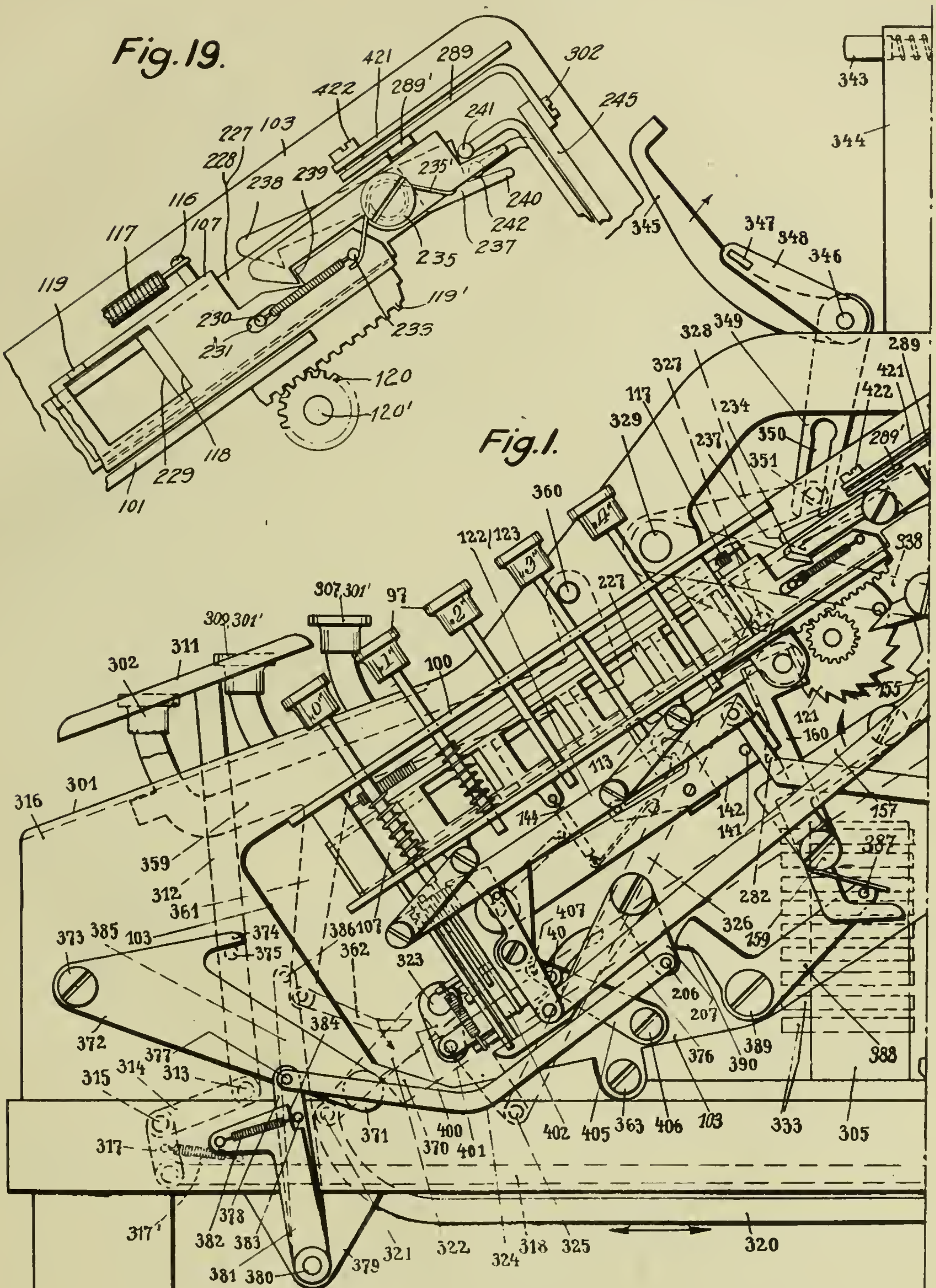
Filed Aug. 12, 1938

Serial No. 224,630

12 Sheets-Sheet 1

Fig. 19.

Fig. 1.



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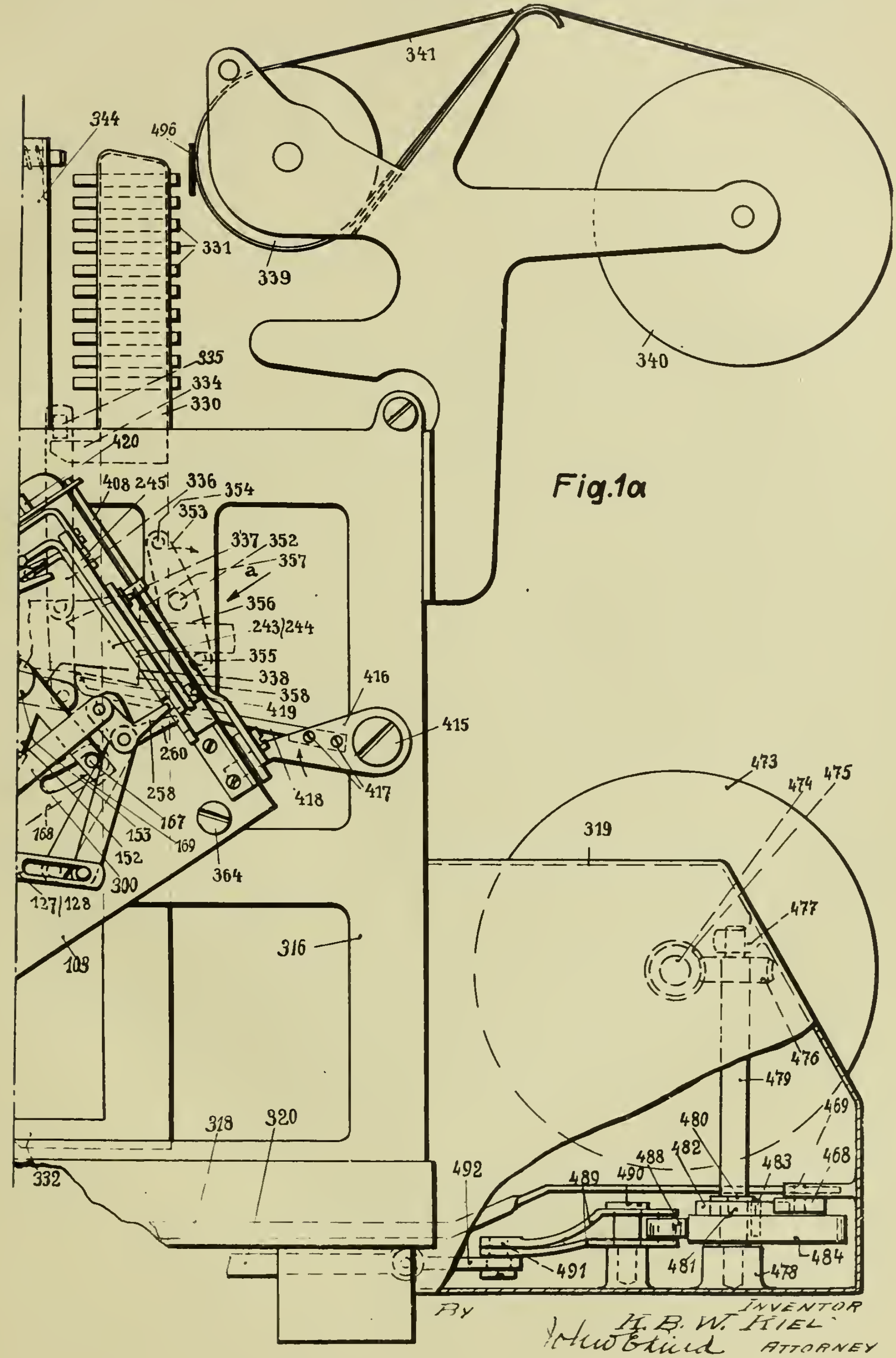

Fig. 1a

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Fig. 2

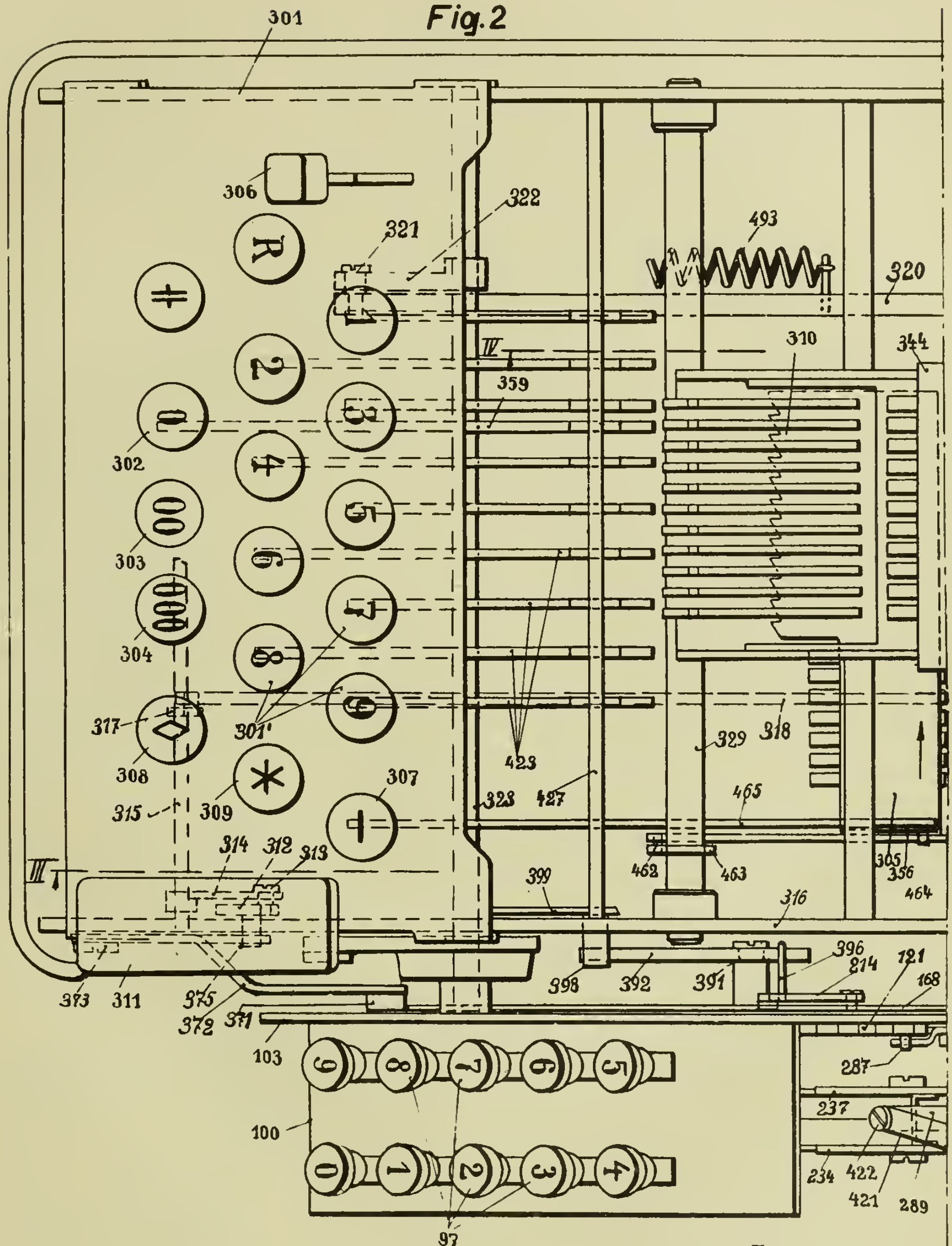

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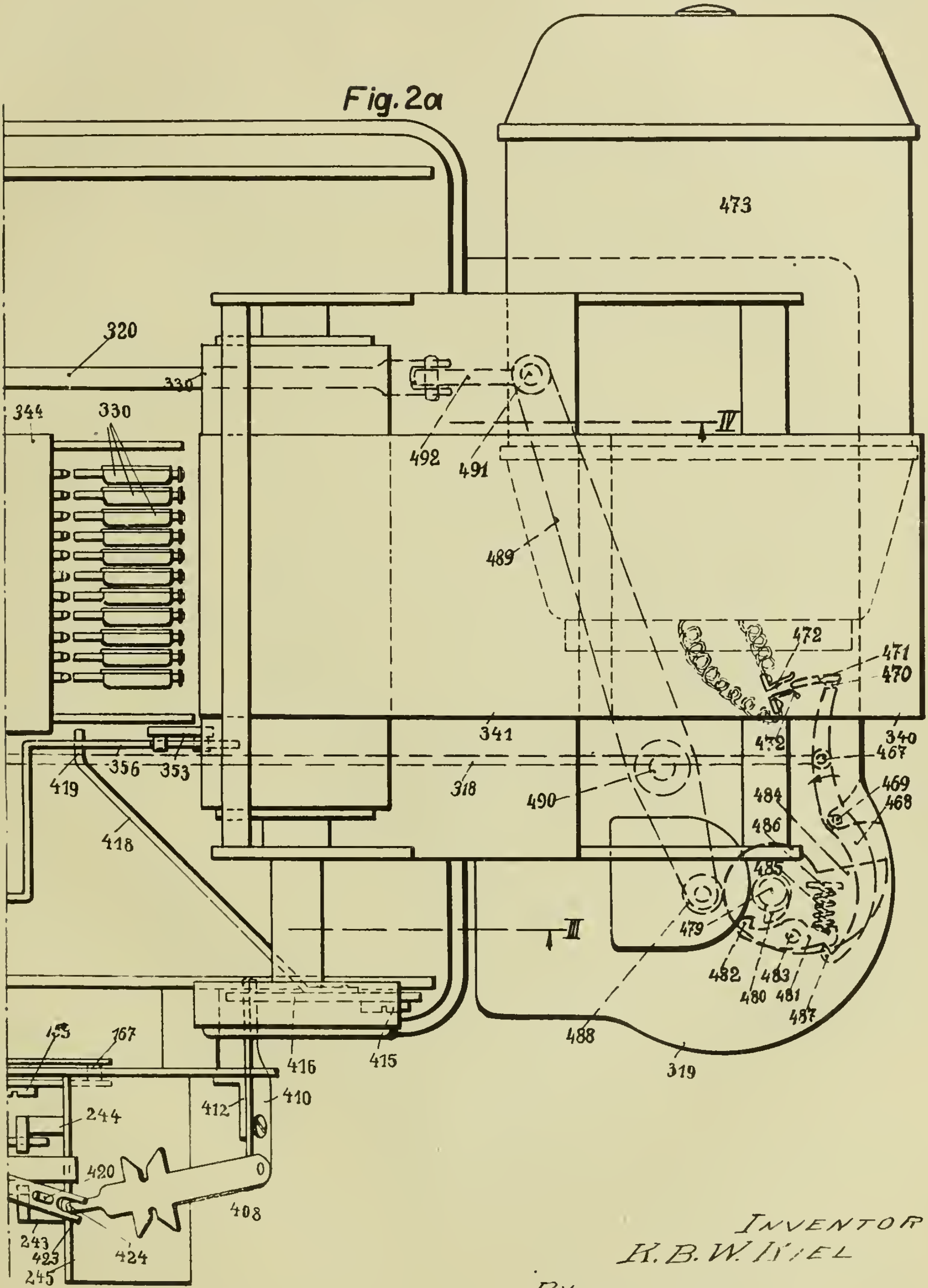
Fig. 2a



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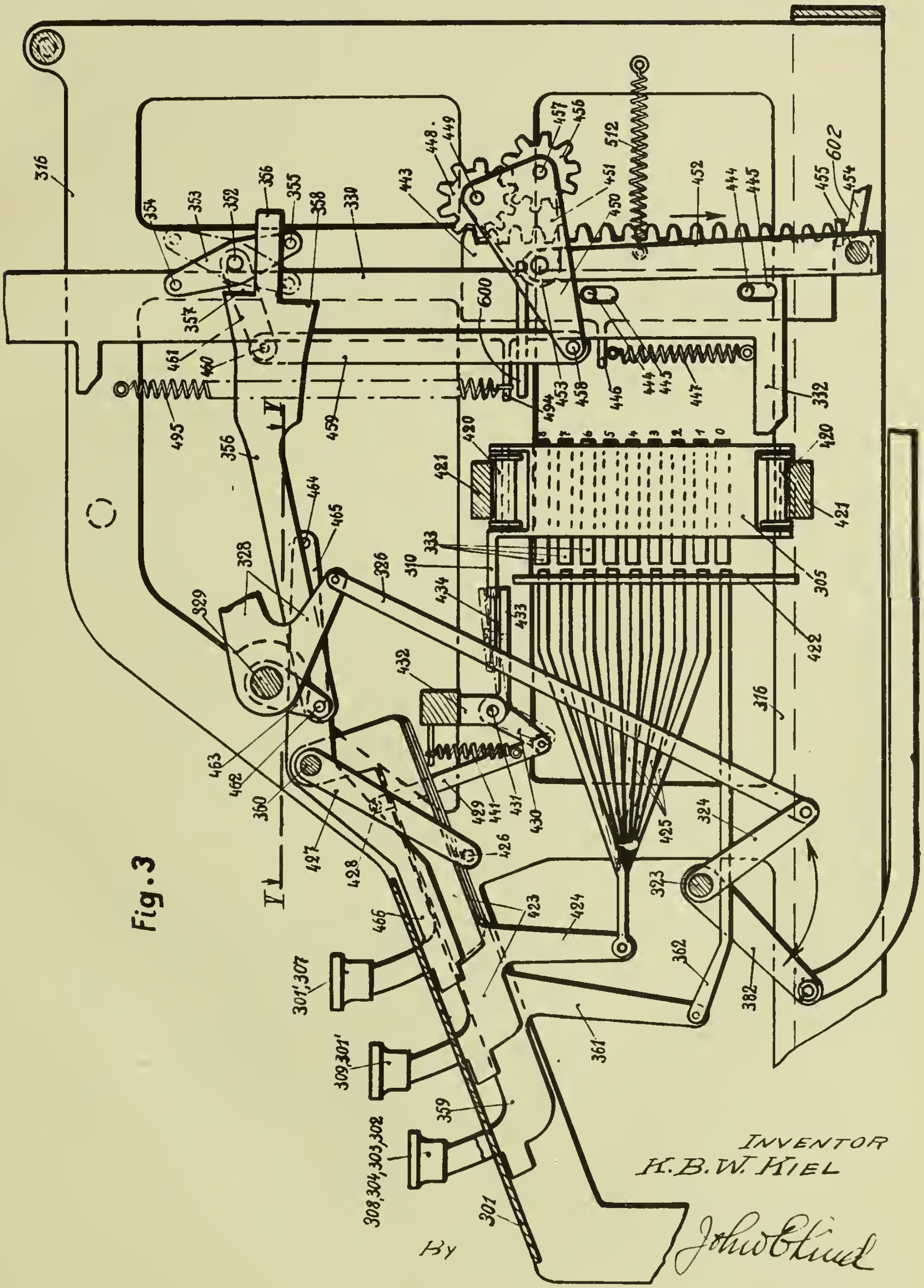

Fig. 3

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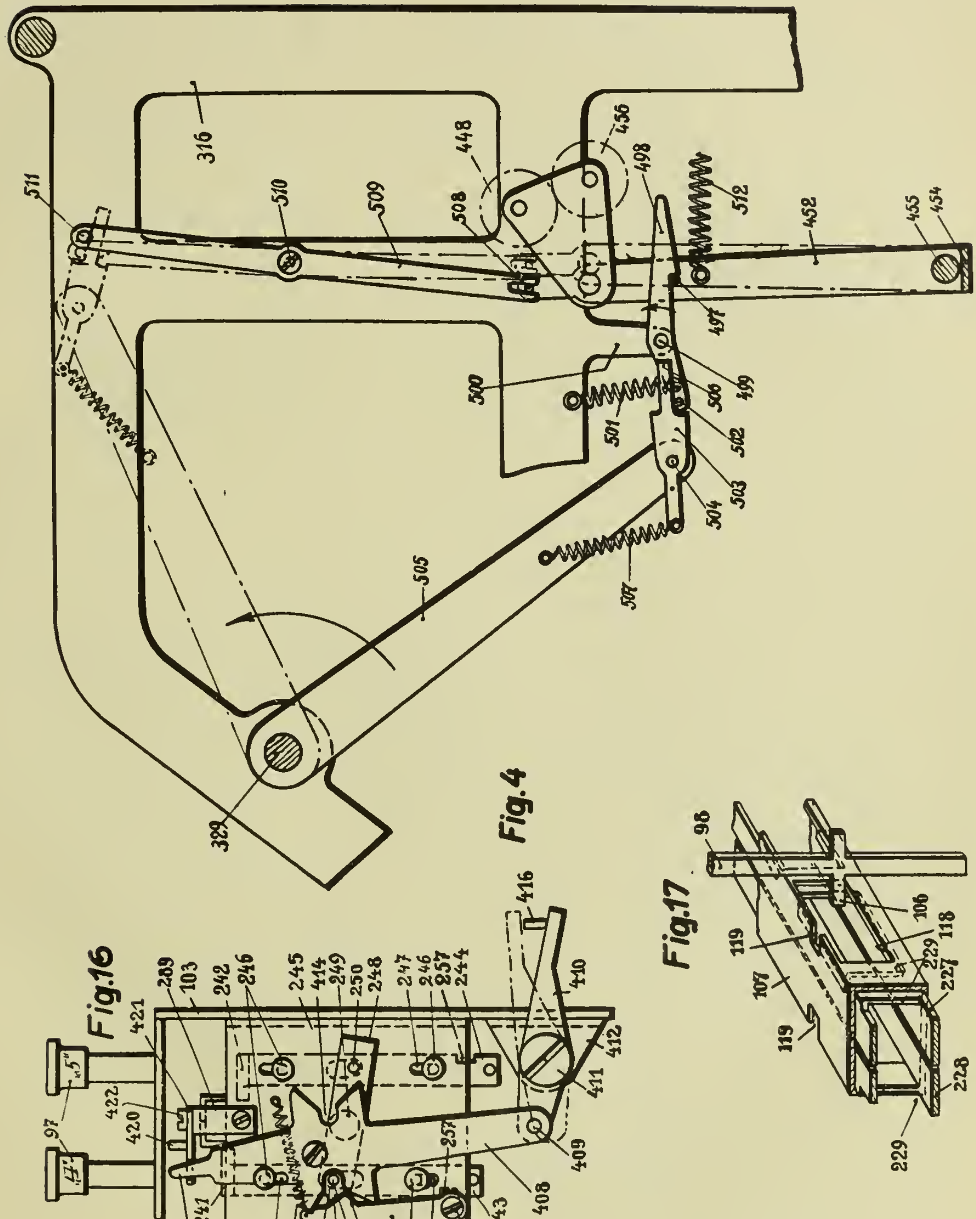

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Fig.14

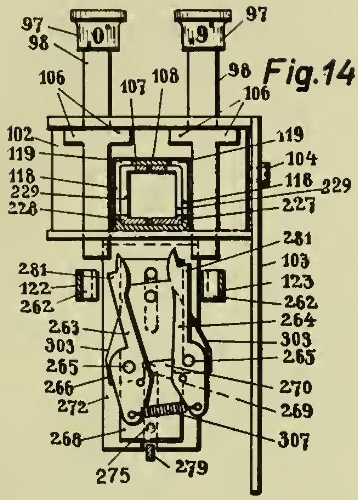


Fig.15

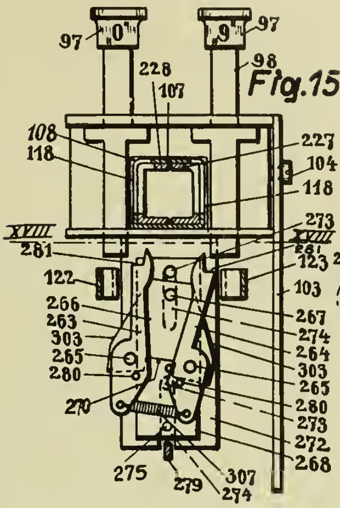


Fig.18

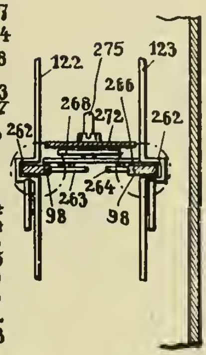
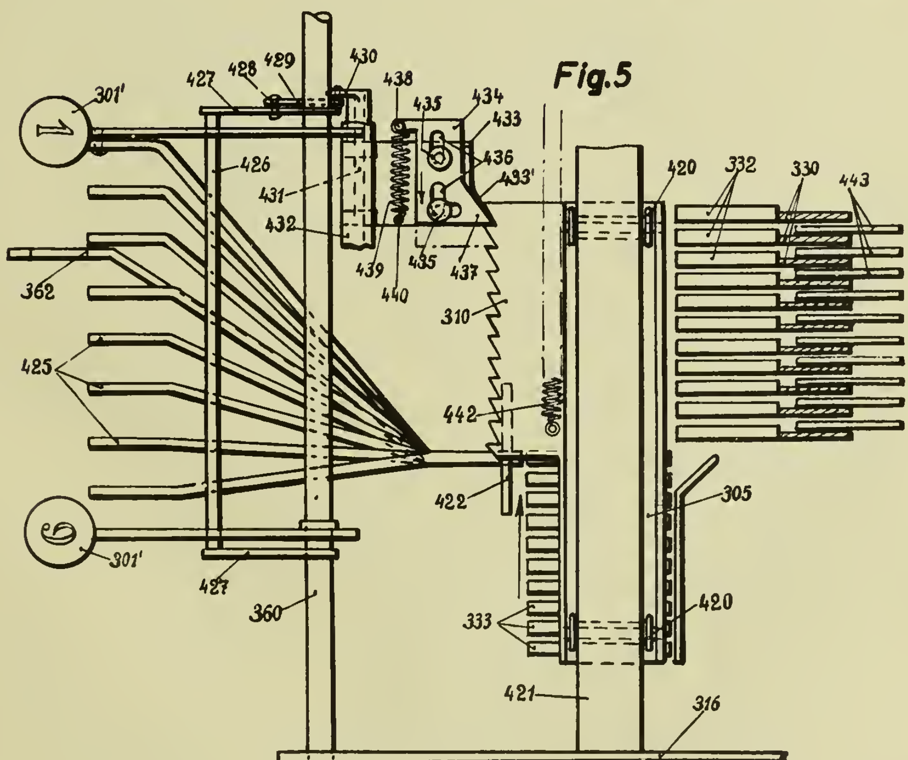


Fig.5



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PUBLISHED
JULY 13, 1943.
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K. B. W. KIEL
ADDING MACHINE
Filed Aug. 12, 1938

Serial No. 224,630
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Fig.13

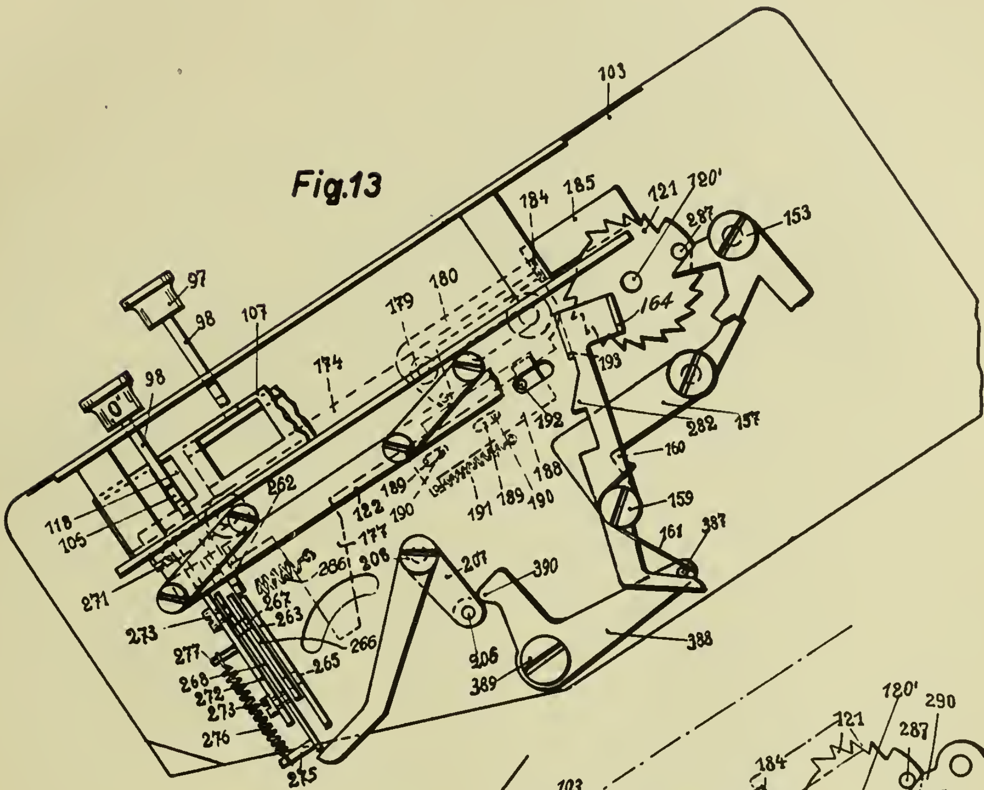
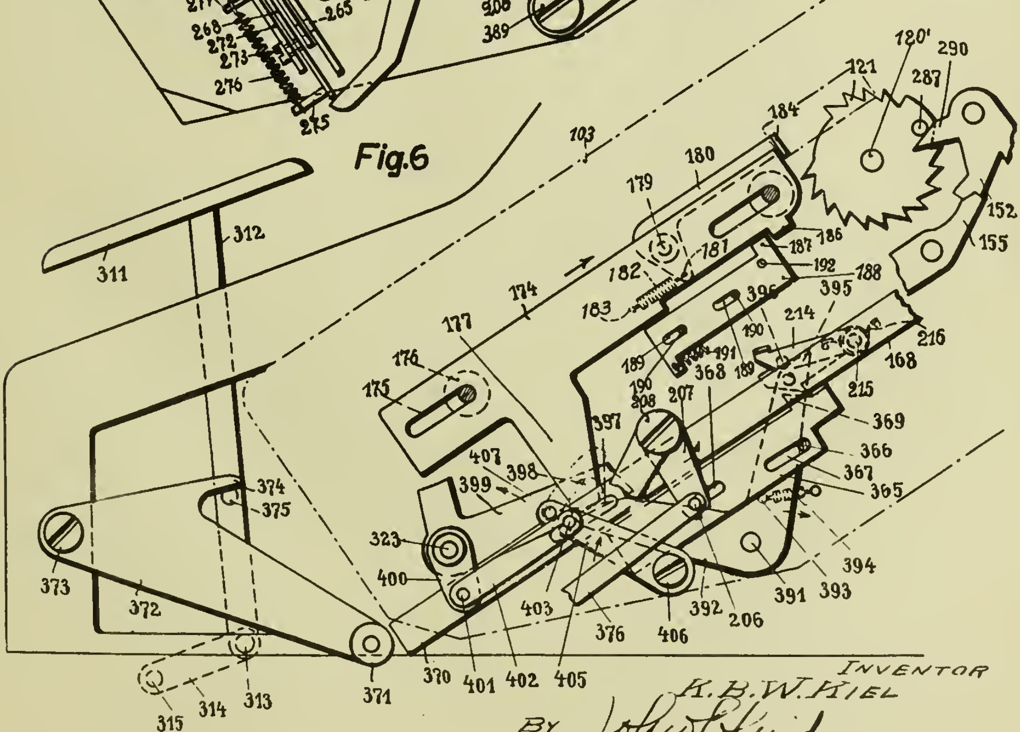


Fig.6



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BY A. P. C.	Filed Aug. 12, 1938	12 Sheets–Sheet 9

Fig. 7

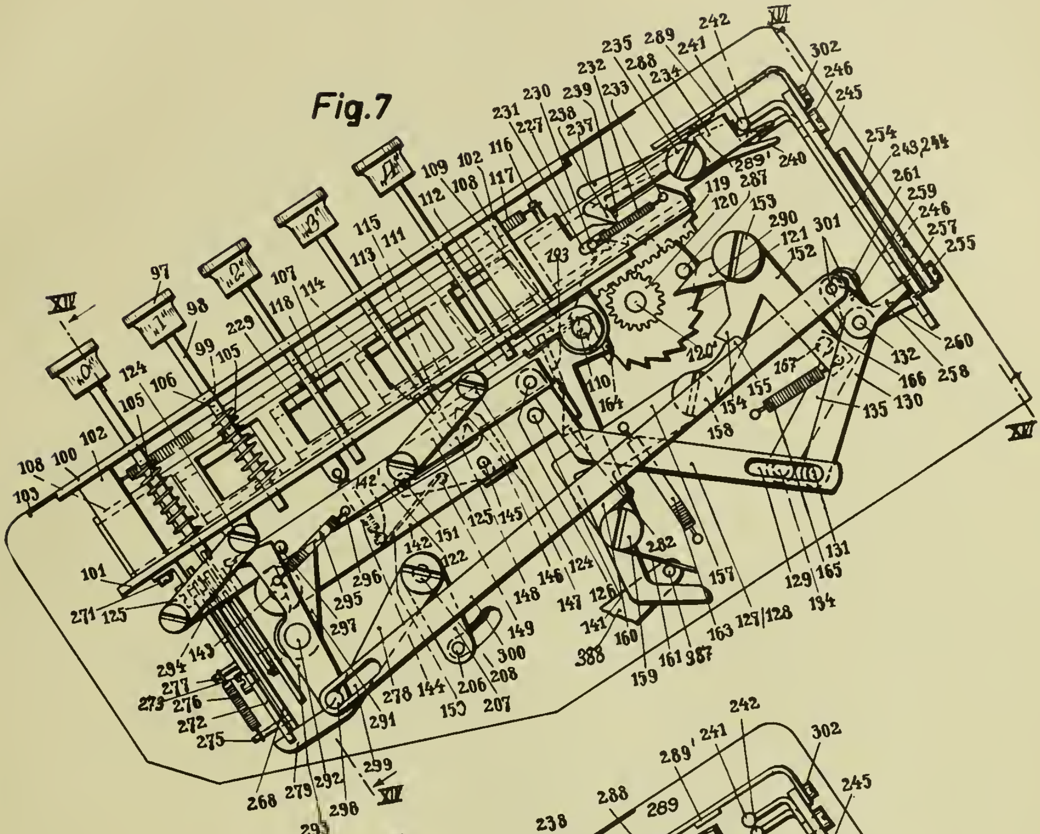
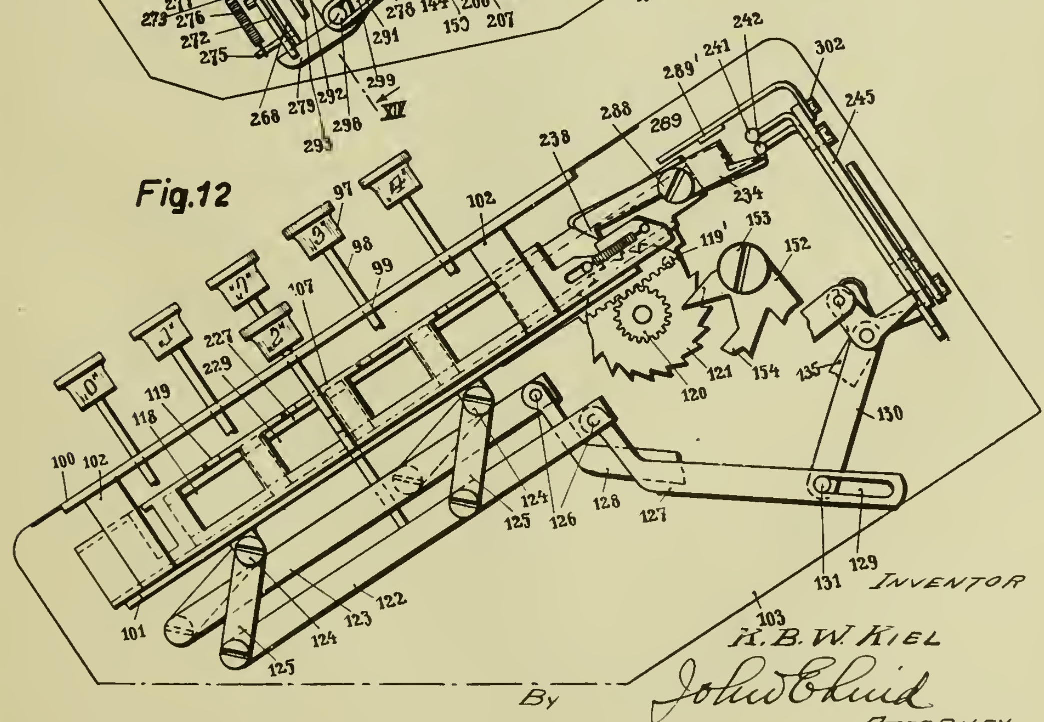


Fig. 12



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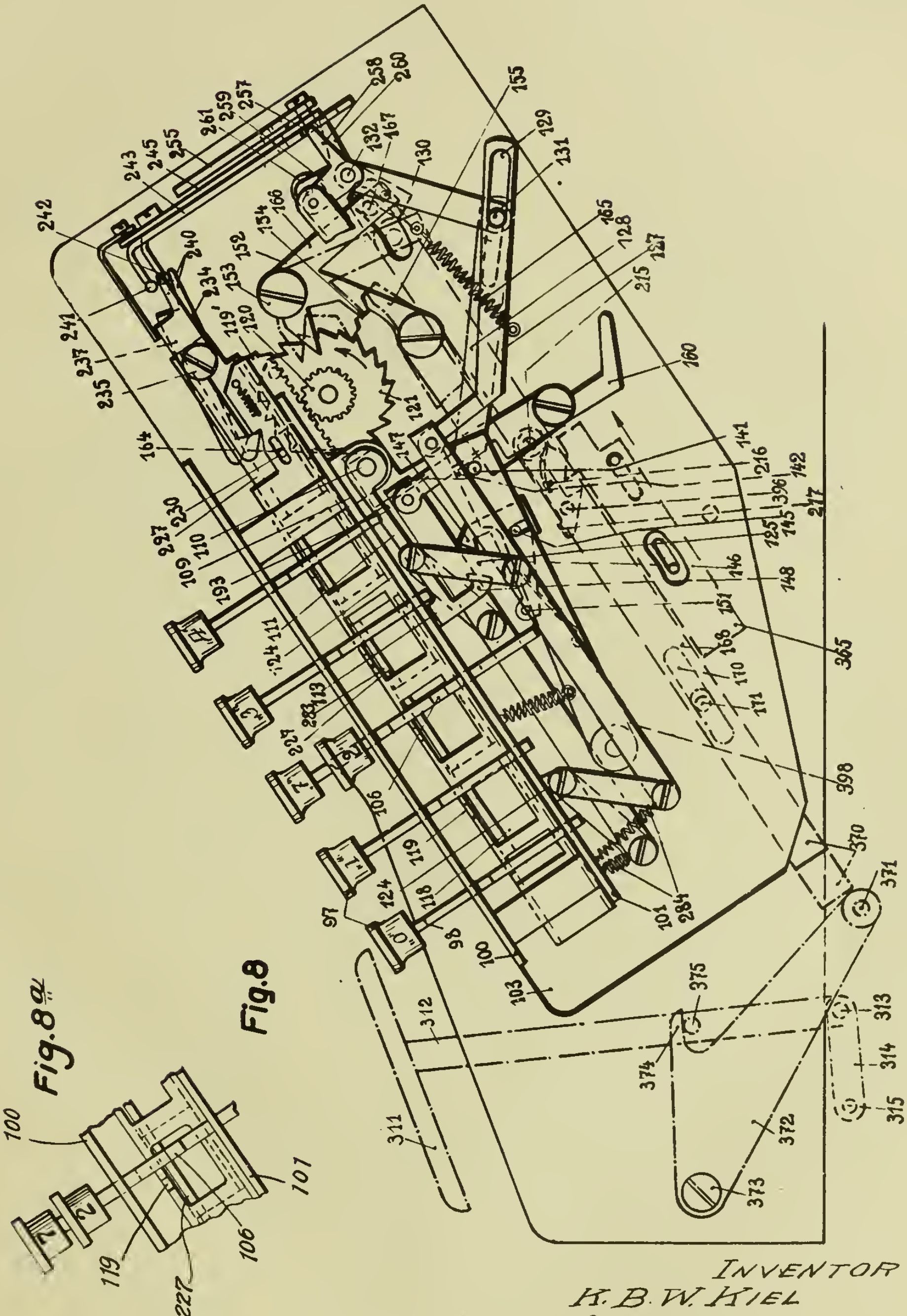

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Fig.9

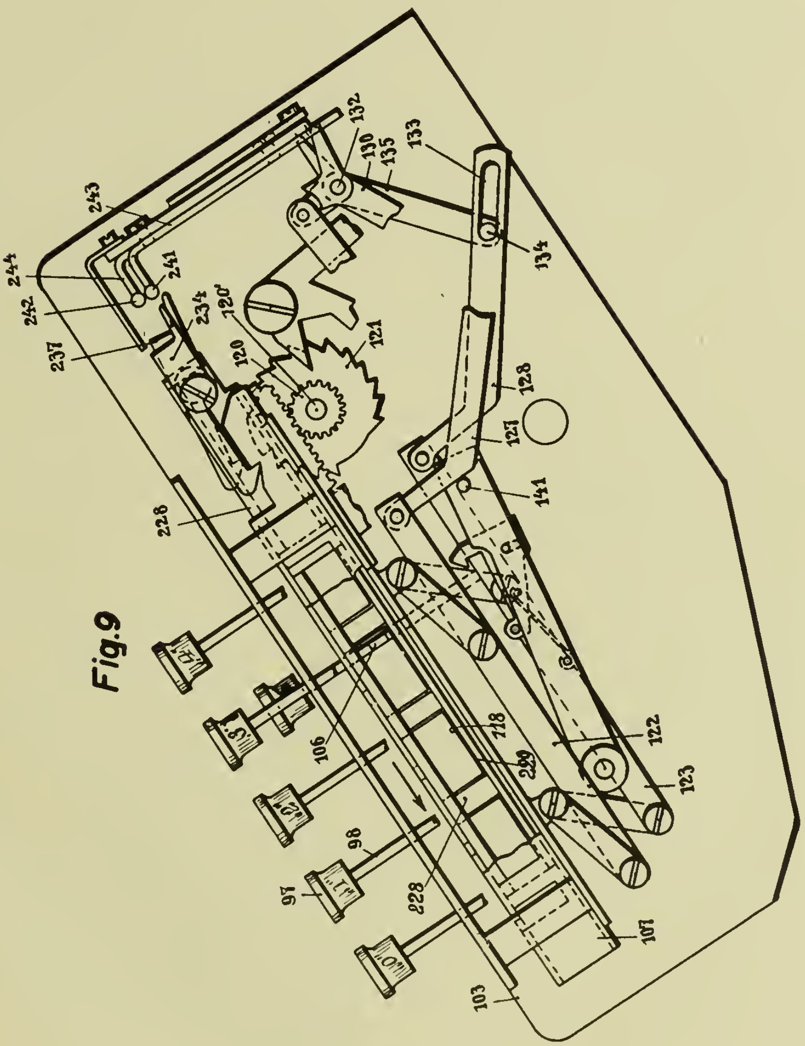

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Fig.10

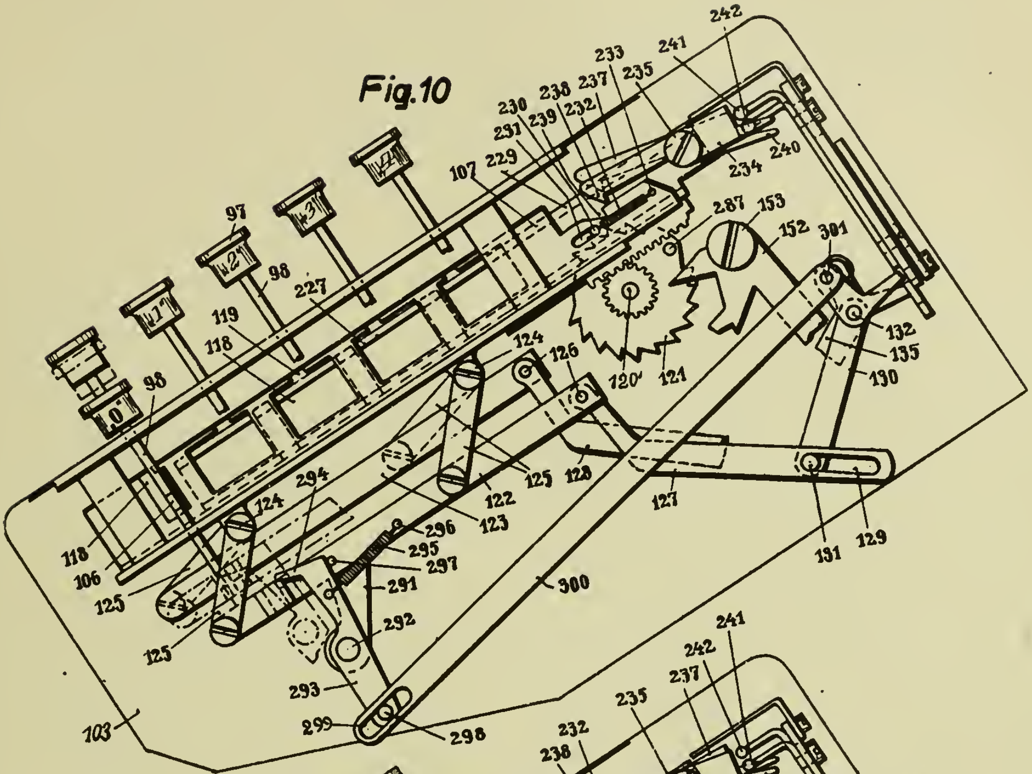
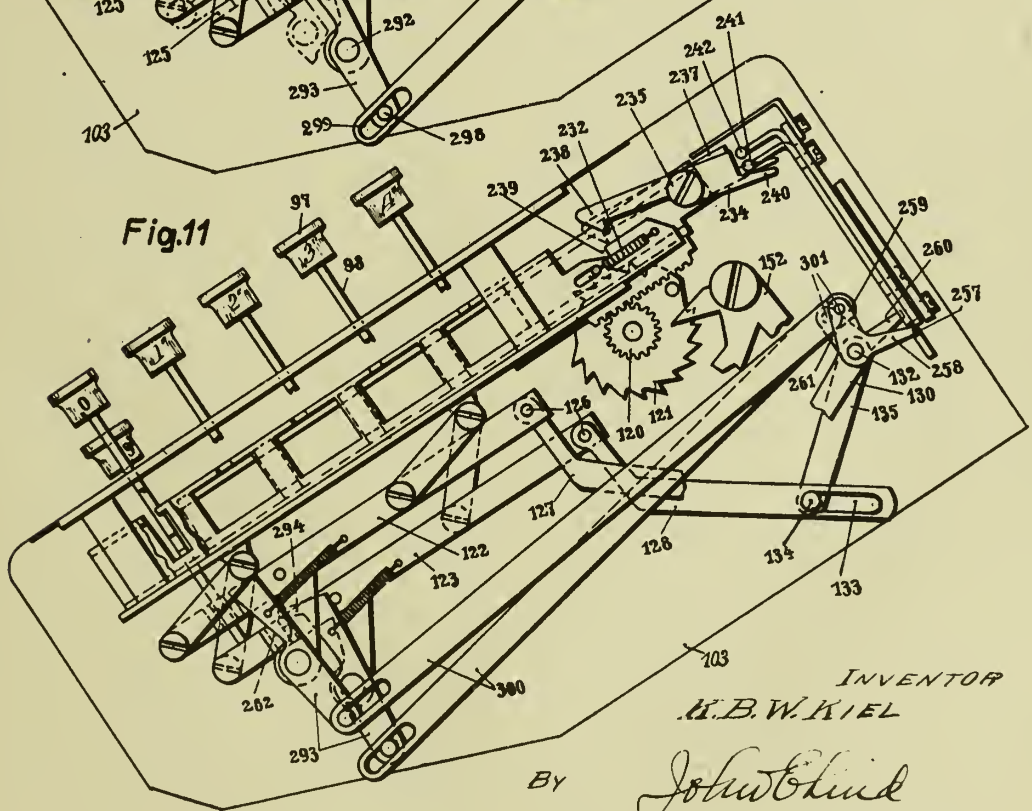


Fig.11



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF RUBBER-ACTIVE SO-CALLED GAS BLACK

Harry Kloepfer, Cologne, and Hans Backe and Richard Hupe, Dortmund, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 11, 1938

Our invention relates to a process for the production of rubber-active, so-called gas black, from anthracene residues, by incomplete combustion.

It is well known that carbon black can be produced by supplying carbon-containing materials in the gaseous or vapour from such, for example, as naphthalene, bnezene, petroleum mixed with air or combustible gases such as illuminating gas, blast furnace gas, generator gas, to burners in which the mixture is burnt with the admission of restricted quantities of air, the lampblack produced being made to deposit, on cooled surfaces.

We have now found by a long series of exactly executed tests that with the use of anthracene residues as initial material for the production of a highly active gas black, such as may, for instance, be used for admixture to rubber, caoutchouc or the like in order to improve the mechanical properties of the latter, a series of conditions must be adhered to in order, on the one hand, to produce a highly active gas black, whilst obtaining a good yield with the incomplete combustion and, finally, keeping the apparatus in which the anthracene residues are gasefied and burnt, in good working order for a long period. With the hitherto known processes for the gase-fication and combustion of anthracene residues, after a comparatively short time blockages of the delivery pipes and of the burners easily took place, frequently even after a very short period making the stoppage and dismantling of the apparatus for the purpose of cleaning, necessary. On the other hand, with the shortness obtaining in initial materials, it was absolutely necessary with yields of black which in general calculated on the carbon-containing substances employed, were very low and for example in the case of naphthalene at the utmost amounted to approximately 35–40%, to make use for the production of the active gas black of such materials which previously were directly burnt in primitive devices with the production of a black of minimum quality and with bad yields only.

According to our invention, the procedure is adopted that a mixture of anthracene vapours is made with those combustible gases, the carbon monoxide content of which is not more than 25% and preferably less than 20%, and partially burning this mixture in burners of definite dimensions with the admission of restricted quantities of air to the flames, letting the black formed deposit in known manner on cooled surfaces. To carry out the process, it is necessary that an admission of oxygen or gases containing oxygen such for example as air, to the carrier gas or vapour mixture before its exit from the burners, be avoided. For it has been found that the presence of oxygen in the gas and vapour mixture to be burnt, before emergence from the burners, leads to decompositions and undesirable changes in the vapourised anthracene initial materials, which on their part are the causes of blockages and incrustations of the gas pipes leading to the burners or the burners themselves. They are used as burners for carrying out the process according to the invention, bored burners with a bore having a diameter not substantially exceeding 0.75 mm or slotted burners having a slot of a width not substantially exceeding 0.5 mm.

Preferably for the gasefication or vaporisation of the anthracene residues, the combustible carrier gas containing carbon monoxide such for example as illuminating gas, coke furnace gas, is allowed to flow over the anthracene residues suitably heated to vaporisation temperature, the carrier gas being thereby charged with the anthracene vapours. For carrying out the process, a gaseous mixture has been found particularly advantageous which contains approximately 400 to 600 g of vaporised carbon-containing substance per cubic metre of gas mixture. In order to attain a charging to the desired extent, the procedure is for example followed that as large a surface as possible of the anthracene residues is brought into contact with the carrier gas, the carrier gas being passed for example in direct or counter-flow over the anthracene residues, or the carrier gas can be led over the anthracene residues at rest, to which in any known manner a sufficient surface is imparted. Preferably the carrier gas is heated to suitable temperatures, preferably to the vaporising temperature of the anthracene residues before it enters the vaporising device. The heating can preferably take place by making use in this of the heat produced by the combustion of the vapour mixture.

In the delivery of the mixture consisting of carrier gas and anthracene vapours to the burners, care must be taken that the temperature of the mixture does not fall to such an extent that a deposit of the anthracene takes place in the pipes or burners. The heating to too high a degree of the pipes must, however, also be avoided in order to prevent a premature decomposition and splitting up of the anthracene. Preferably the temperature up to the burners is maintained so that it does not exceed 350 to 400°C.

The deposition of the black formed during the combustion takes place in known manner on cooled devices, e. g., cylinders, movable sledge-

depolariser, may give good results in certain cases, I prefer to use alternating current.

In order to increase its resistance to corrosion, the part while still in the damp state may be immersed in a bath which is at a temperature of 95° C. and containing per litre:

	Grams
Sodium aluminate	20
Sodium silicate	20
Soda	8

The part is withdrawn from this bath after five minutes, and dried. The part is covered with a protecting layer chiefly composed of Al_2O_3.

It is also possible to apply a coat of paint on the articles made of light metals which are protected by the present process. In this case, it is preferable to apply said coat of paint without effecting the second treatment by immersion in a hot solution of silicates and of aluminates.

JEAN FRASCH.

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ALIEN PROPERTY CUSTODIAN

CINEMATOGRAPH CAMERAS

Otto Steiner, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed December 28, 1938

My invention relates to cinematograph cameras for selective use of exchangeable film magazines, and is a division of my application, Serial No. 126,870, filed February 20, 1937.

An object of my invention is to provide a cinematograph camera which may be used for taking pictures with films of different widths, and which allows changing from one to another width by merely exchanging the film magazine.

Another more particular object of my invention is to provide a film camera which is capable of being supplied with a film having one row of pictures of sub-standard size as well as with a film of double width for taking two rows of pictures.

A further object of my invention is to design the take-up shaft of a film camera in such a way as to prevent overstressing of the film by reliable and space-saving means. An object also is to provide means within the feeding shaft of the camera for preventing an undesired unwinding of the film. More particular objects consist in constructing and arranging the above-mentioned means in such a way as to ensure simplicity and sturdiness and easy handling of the camera mechanism.

According to my invention, a cinematograph camera is provided with different magazines adapted for films of different sizes or of a different number of picture rolls, and the camera as well as the magazines are designed to allow an exchange of the magazines while using the same fitting and coupling means of the camera.

The advantages of such a camera are self-evident. For producing a film of the sub-standard size, it is possible to alternately employ without any loss of time a film already cut to the sub-standard size or a film of the double width which is to be cut into two strips of sub-standard size after the exposure or the developing of the film.

According to the invention, further, the magazine and the spool shafts arranged in the camera are designed in such a manner that either a film spool for films of wider size, or only one of two coaxial spools for films of sub-standard size is coupled with the mechanism of the camera.

The coupling means, provided according to my invention between the camera mechanism and the film spools, are preferably of the resilient type in order to enable the accommodation of magazines containing the spools or the film take-up cores in any relative position of these spools or cores.

Further objects and characteristics of the invention will be apparent from the following description.

In the accompanying drawings are shown some embodiments of my invention in diagrammatic form.

Fig. 1 shows the total view of a cinematograph camera provided with a magazine according to the invention with open camera cover and magazine partly shown in section.

Fig. 2 is a view of the same camera with the magazine viewed from the left-hand side, the magazine cover being partly broken away.

Fig. 3 is a vertical sectional view of the film take-up shaft of the camera, illustrated in the preceding figures.

Fig. 3*a* shows a spring of the arrangement shown in Fig. 3, in perspective.

Fig. 4 shows the film take-up shaft of Fig. 3 in connection with a double magazine containing two films already cut to the sub-standard size.

Fig. 5 shows a modified form of the take-up shaft, the shaft being shown in cross section and in connection with a daylight reel for films of a wider size arranged in a magazine.

Referring at first to Figs. 1 and 2, the camera and the film magazines are constructed as follows:

The cinematograph camera is designated by the numeral **20**, and its objective by the numeral **23**. The camera contains a detachable film magazine **24**. The chamber for this magazine is covered by a door-like cover **21** hinged to the camera enclosure at **22**. The magazine contains two film spools **47** and **47'**, as indicated in Fig. 2. The film **7**, coming from spool **47'**, is led to the take-up spool **47** so as to pass between a film gate **1** and a pressure plate **5** holding the film against the gate. **39'** designates a feed shaft and **39** a take-up shaft forming parts of the camera. The camera contains a mechanism for actuating the take-up shaft **39**. The mechanism is disposed in the lower part of the camera enclosure with relation to the view shown in Fig. 1. The wall of the magazine **24** forms a recessed part **15**, allowing the pressure plate **5** to catch behind the film when inserting the magazine into the magazine chamber of the camera. During the insertion of a magazine, the feeding shaft **39'** and the take-up shaft **39** pass through the axle holes of the spools **47'** and **47**. In order to limit the lateral clearance of the film **7**, a plate spring **10** is secured to the cover **21** by means of rivets **11**. Two springs **10'**, fixed to cover **21**, secure the

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Fig. 1

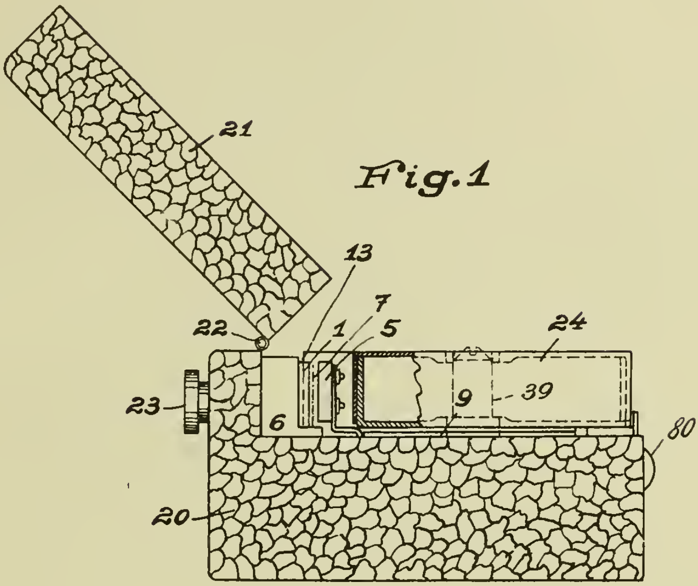
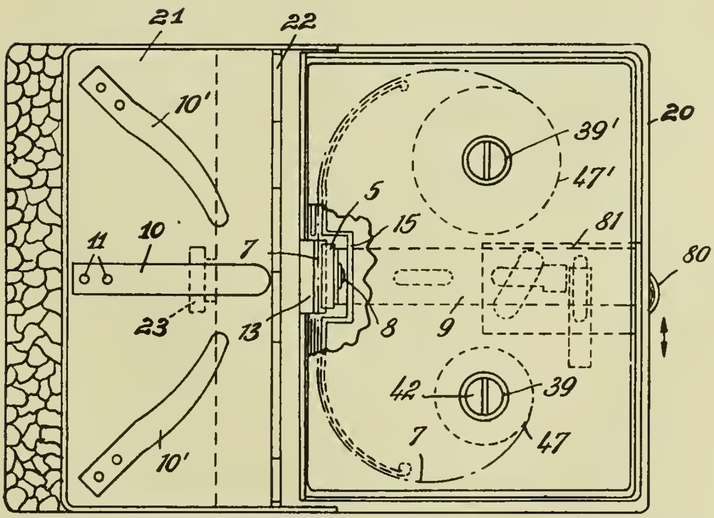


Fig. 2



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CINEMATOGRAPH CAMERAS
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Fig. 3

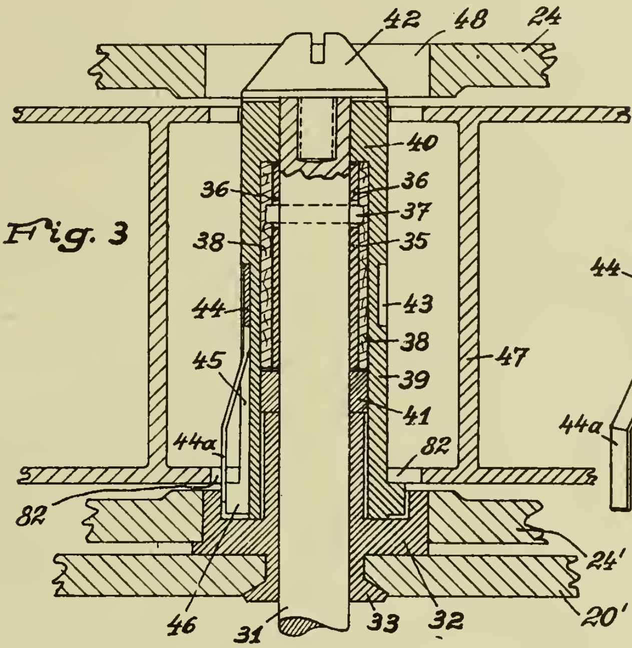

Fig.3a

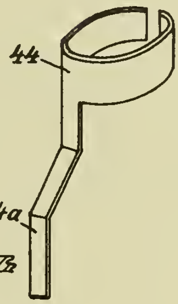

Fig.4

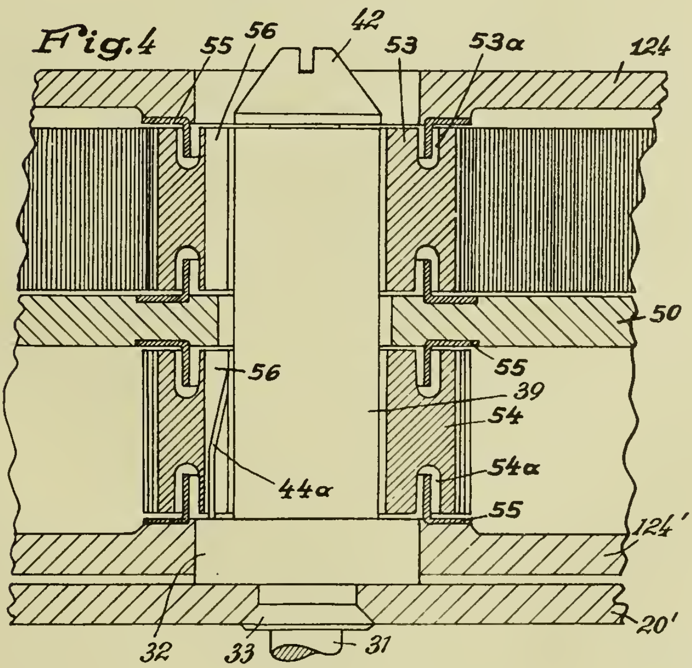

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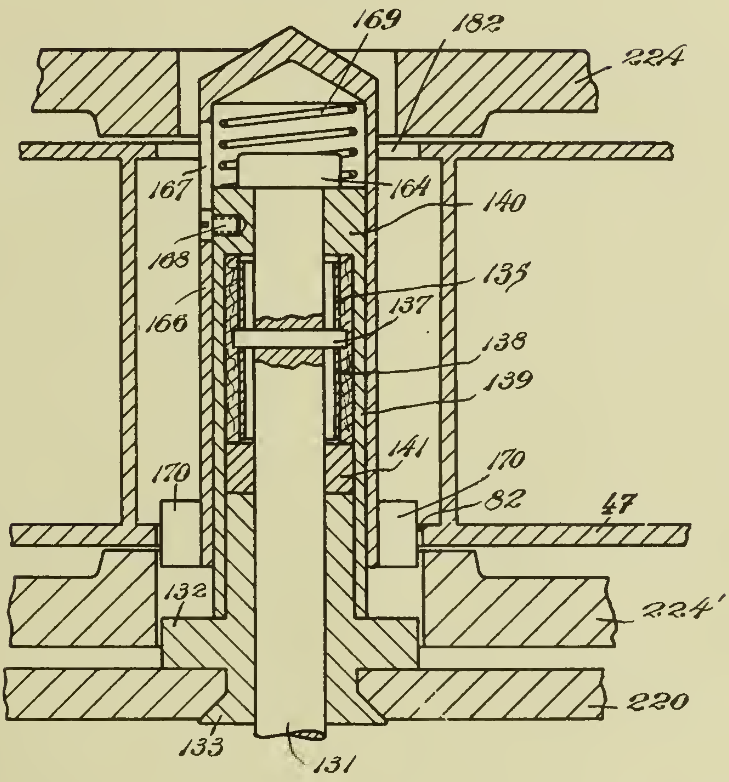
Fig. 5



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ALIEN PROPERTY CUSTODIAN

CEMENTATION OF METALS AND METAL ALLOYS WITH BERYLLIUM

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No Drawing. Application filed December 30, 1938

The present invention relates to improvements in or relating to the cementation of metals and metal alloys with beryllium.

It is an object of the invention to cement with beryllium, objects produced from metals such as iron, for example cast iron, steel, normalized steel and the like, further objects produced from metals such as copper, silver, nickel, aluminium and the like and from metal alloys of the most varied kind, for example bronzes and the like.

It is known that beryllium reacts extraordinarily readily with all kinds of compounds and substances, especially with oxygen and nitrogen, and with steam, carbon dioxide and the like. Because of this property of beryllium, it was to be expected that satisfactory cementations would only be obtained if it were possible to protect the beryllium adequately during the heat treatment. Experiments in which a metallic object to be cemented was packed in pulverulent beryllium in order to protect the beryllium particles, which lie upon the metal surfaces to be cemented, by the layers disposed thereabove have not led to satisfactory results. In any event this process is impracticable because of the relatively high price of beryllium.

It has now been found that excellent cementations may be obtained if a thin layer of beryllium is applied to the surfaces to be cemented and the beryllium caused to diffuse into the base metal by heating. It has been shown that with this method of working diffusion of beryllium into the base metal takes place so rapidly and completely that in spite of the great affinity of beryllium for oxygen, nitrogen, steam, carbon dioxide and the like disturbing reactions do not take place.

The beryllium, when applied in a thin layer, may surprisingly be caused to diffuse completely into the base metal considerably more rapidly than when it is applied by the above mentioned packing process. This ability to induce rapid and complete introduction with complete utilisation of the expensive beryllium employed and to obtain very uniformly cemented products is of considerable technical and economic importance. Objects cemented with beryllium by the above process are distinguished by very hard surface layers and particularly high resistance to mechanical influences, temperature influences and the like. In fact effects may be obtained which are not obtainable by known cementation processes.

It is also, inter alia, an advantage of the process that it may be carried out in a readily regulable manner and thus makes it possible to produce products of desired properties. For example, the quantity of beryllium to be introduced into the base metal may be exactly predetermined by choice of the thickness of the beryllium layer applied to the base surface. Moreover, a more or less deep penetration of the beryllium into the base metal or, for example, the production of surface layers of desired degree of hardness may be obtained very simply by temperature regulation. For example by applying relatively thin beryllium layers and employing relatively high temperatures, a thin surface layer of great hardness may be obtained. Moreover, for example by employing thicker beryllium layers and observing relatively high temperatures, surface layers may be obtained which are not only very hard but are also distinguished by great resistance to mechanical influences, temperature influences and the like. Greater depth effects may for example be obtained by use of thicker beryllium layers and relatively low temperatures. Further controls are, for example, available by carrying out the cementation in steps at temperatures of various heights, for example first at relatively lower and then at relatively higher temperatures. Variations may also be obtained by employing various periods of heating or temperatures of various height with periods of heating of various lengths. A further possibility consists, for example, in first allowing a beryllium-containing layer to diffuse in, thereupon applying a further layer, allowing the latter to diffuse in by heating and if desired repeating this process frequently. In this way great depth effects may for example be obtained with only very gradual transitions and hence particularly homogeneous and resistant cementation layers may be produced.

The heat treatment should be carried out at temperatures at which a disturbing fusion of beryllium or of the base metal does not take place. Suitable cementation temperatures lie principally between about 800 and 1100° C., preferably between about 850 and 1000° C.

The heat treatment may advantageously be carried out in vacuo or in an atmosphere of inert gas, for example in an atmosphere of hydrogen or of the rare gases, such for example as argon. The heating may be effected by methods known per se, for example by means of hot gases, radiant heat, Joule heat, turbulent current heating or in fused salt baths. The process may also for example be such that only the first part of the heat treatment is carried out with exclusion of

aggressive gases, whilst further diffusion may be effected without these precautionary measures.

Beryllium coatings may for example be produced on the base metal by incorporating beryllium in as finely divided as possible a form in lacquers or similar media such, for example, as resins, artificial resins and/or other vaporisable or combustible substances or mixtures of substances and applying the products so obtained to the base in suitable manner. Suitable lacquers are for example those having a base of cellulose esters, artificial resins, rubber, resinates, oil lacquers and the like. Known solvents, softening agents and the like may be added to the lacquers, resins and the like. The usual measures such as dipping, spreading and spraying may be employed for the application of the substances or mixtures of substances containing the beryllium in suspension.

The beryllium may also be applied to the base in admixture with inert, fusible substances, such, for example, as calcium fluoride.

Application of the beryllium as a component of the sprayable, dippable or spreadable lacquers and the like makes possible, in particular, uniform cementation of complicated space structures, such as armatures, large apparatus parts and the like.

In many cases it has proved advantageous to roughen up the base metals superficially by means known per se, for example by means of sand jet blasts, etching liquids or electrolytically. A somewhat lattice-like form may for example be imparted to the surfaces. The application and adhesion of the beryllium or of the beryllium-containing products such as lacquers or the like, and the subsequent diffusion into the metal may be favoured by employing surfaces of this kind. It has been found that the beryllium may also be caused to adhere sufficiently to the base metal on such rough surfaces without use of binding agents and the like, for example by powdering in, pressing in and the like.

Of course there are other possible ways which are suitable for applying the beryllium in a uniform and sufficiently adhesive layer to the base metal, such for example as the metal spraying process which is particularly suitable for the treatment of large metal objects.

According to one embodiment of the invention, other metals or metal alloys besides beryllium are also caused to diffuse into the base metal. In this way it is possible extensively to influence the properties of the cemented surfaces of the base metal in desired directions. Suitable additional cementation agents for the cementation of iron, steel, normalized steel and the like, are for example copper, nickel, tungsten, titanium, vanadium, aluminium and the like. The beryllium may be applied to the base metal together with suitable quantities of additional metals, for example by powdering on or pressing on to roughened surfaces or, for example, in the form of lacquers or the like. If desired thin layers of beryllium and of additional metal, for example copper, may also be applied alternately to the base metal. In this case the layer last applied advantageously consists of the additional metal, for example copper, and in this way the beryllium is provided with a protective coating. Finally the beryllium may also be applied to the base in the form of alloys which contain the additional metal or the additional metals.

On heating to suitable temperatures, both the beryllium and also the additional metal or the additional metals diffuse into the base metal; according to the quantitative relation of the metals introduced and also the sequence of introduction and the like, special effects may be obtained.

According to another embodiment of the invention, besides beryllium or beryllium and additional metals, other cementation agents such, for example, as coal, silicon and the like are also caused to diffuse into the metal to be treated. This may for example be effected in a simple manner by applying the beryllium to the base metal together with components which are carbonised on heating, for example in the form of lacquers, or by adding carbon, silicon or like components in suitable quantitative proportions to the beryllium or the beryllium-containing mixtures.

According to a further embodiment of the invention a beryllium compound or beryllium compounds is/are applied to the base metal, or a coating is applied which contains a beryllium compound or several beryllium compounds, the beryllium is then set free from its compounds and caused to diffuse in.

Thus, for example, organic beryllium compounds, such, for example, as beryllium dimethyl, or beryllium diphenyl, may be vaporised and precipitated onto the surface of the metals or metal objects to be improved. If in this case the base metal is maintained at suitably high temperatures, the metallo-organic compound decomposes and precipitates finely divided beryllium which is introduced into the base metal by further heating to temperatures suitable for the diffusion in of the beryllium.

If desired also a mixture containing a reducible beryllium compound for example beryllium oxide, beryllium chloride, beryllium fluoride and the like, and a suitable reducing agent, may be applied as a coating to the base metal, the reduction of the beryllium compound may then be effected by heating and the beryllium set free may be caused to diffuse into the base metal by further heating.

As reducing agents, metals may advantageously be employed which are capable of forming alloys with the metallic beryllium set free.

Thus for example, the base metal may be provided, for example electrolytically, with a coating of strongly electropositive metals, such, for example, as sodium, magnesium, aluminium or calcium, the beryllium compound, for example beryllium chloride, may then be applied, if desired in admixture with other suitable substances, for example alkali chloride or other suitable fluxes, preferably in a reducing atmosphere, and heated to produce complete or partial reduction of the beryllium compound to metallic beryllium. The beryllium set free is then caused to diffuse practically completely into the base metal by heating, the process being controlled if desired as described before.

If desired also the base metal may be coated with the reducing agents and then treated at higher temperatures with beryllium compounds in vapour form, for example with beryllium halides and the beryllium set free caused to migrate into the base metal by increase of temperatures.

The reducing agent, for example magnesium or aluminium, may be employed in such quantities that it is present in more or less great

excess and diffuses in together with the beryllium.

Other metals, such, for example, as copper, nickel, cobalt, silver etc. may also be introduced besides the beryllium into the base metal and in this way the properties of the surface layers cemented by beryllium may be varied in desired manner. For example, a coating of more noble metals, for example copper, nickel, cobalt, silver, may first be applied electrolytically to the base metal and likewise a coating of less noble-metals, such as magnesium or calcium, may be applied electrolytically to this first coating. Thereupon a suitable compound yielding metallic beryllium, for example beryllium chloride, may be applied in the above described manner. Reduction of the beryllium compound to metallic beryllium and alloying of the beryllium metal with the other metal, for example copper, may be effected by heating, and the alloy produced may then be caused to diffuse into the base metal by further heating.

The beryllium compound yielding metallic beryllium for example beryllium chloride, may also be applied in admixture with reducing substances other than those above mentioned, for example in admixture with coal, carbides or hydrides of the alkali or alkaline earth metals. In this case, besides beryllium and if desired also other metals, cementation agents of another kind such, for example, as carbon, may also be introduced into the base metal and special effects may be obtained, for example, as regards hardness.

The base metal to be improved may be provided with a coating of lacquers or the like containing the beryllium compound, the additional substances necessary for setting free the metallic beryllium and if desired also other additions, for example other metals or coal or silicon and the like. For example a desired lacquer having a basis of cellulose esters, resins or artificial resins, varnishes, softening agents, solvents and the like may be mixed with beryllium oxide or beryllium chloride and suitable reducing agents, for example finely divided magnesium, calcium etc.; moreover other substances such, for example, as coal, finely divided metals, such for example as copper, nickel and the like, or compounds suitable for giving such metals, for example oxides capable of reduction under the given conditions may be incorporated with the lacquer. Such lacquers may be applied to the metal object to be improved, for example by spreading, dipping or spraying. Thereupon the lacquer substance is advantageously heated in an inert or reducing atmosphere until decomposition of the lacquer substance takes place, whereupon the temperature is raised to the degree necessary for the reduction of the beryllium compounds and if desired of other metal compounds and if desired for the alloying of the beryllium with other metallic components, and the beryllium and if desired other substances to be introduced in the base metal are caused to diffuse in by heating to suitable temperatures. Working with lacquers and like products is particularly suitable for improving apparatus parts, armatures and the like of complicated constructions, and especially for improving hollow spaces which can be coated with the lacquer, for example by spraying or like measures.

Objects such, for example, as plates with level surfaces may advantageously be improved by applying the beryllium in a layer of suitable thickness to the surface of a plate laying a corresponding second plate thereupon and subjecting the plates thus united with one another to a common heat treatment. It is thus possible to cause the beryllium or also mixtures of beryllium with additional components to diffuse into the surface of the two plates simultaneously. It is moreover an advantage of this procedure that the beryllium is protected against the influence of air and other disturbing gases so that it is not necessary to employ special measures for excluding air and other disturbing gases. It is advisable when working in this way to take precautions to ensure as intimate as possible a contact by pressing together the plates, sheets and the like.

The diffusion in the beryllium and if desired also of other cementing or otherwise favourably acting substances by heat treatment may advantageously be induced in most of the embodiments described by using baths of fused liquids.

GUSTAV JAEGER.

[illegible]

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR HARDENING FILES

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No Drawing. Application filed January 13, 1939

Our present invention relates to an improved process for, and composition for use in hardening files.

In order to harden files, which in general have a carbon content of between 0.5 and 1.5%, the files are generally heated in baths of fused lead to relatively high temperatures, for example temperatures of about 800° C. and the files are thereupon quenched for example by introducing them into brine. In this process the files are coated prior to the heat treatment with a protective layer for preventing decarbonisation and undesired deposition of lead.

It is an object of the present invention to provide suitable baths of fused salts for the heat treatment of files, instead of lead baths which give off vapours injurious to health at the necessary high temperatures and moreover have further disadvantages.

Experiments which have been made with a view to solving this problem by means of fused salt bath, which contained alkali cyanides as agents for preventing decarbonisation, have shown that it is not possible to employ known cyanide-containing fused salts, which are suitable for the heat treatment of metals, for the heat treatment of files which it is desired to harden. This will be understood when it is considered that it is a matter of objects with roughened or toothed surfaces which must combine a plurality of important properties, such as hardness, gripping power, resistance to breakage, great durability etc. Experiments with fused salt baths which contained large quantities of alkali cyanides for example between 25 and 75% have proved unsuccessful. Files treated in these baths did not possess sufficient gripping power. Experiments with baths which contained small quantities of alkali cyanides in admixture with the usual inert salts, such as alkali chlorides or mixtures of alkali chlorides and alkali carbonates, also did not give technically satisfactory results. In the last mentioned case undesired decarbonisation was observed inter alia.

Further extensive experiments have led to the surprising result that files may be hardened to give excellent products, if fused baths are employed for the heat treatment which contain, as the agent preventing decarbonisation, cyanides in quantities not exceeding 25% of the total fused bath and also alkaline earth halides, preferably alkaline earth chlorides, and alkali halides, preferably alkali chlorides.

A preferred alkaline earth halide for this purpose is barium chloride, which can be employed in large quantities without producing any undesired effects. On the other hand strontium chloride and more particularly calcium chloride may cause an undesired decomposition of the cyanide with separation of carbon.

It is accordingly advisable to employ the halides of strontium and in particular of calcium in relatively small quantities which do not cause undesired decomposition of the cyanide with separation of carbon when the heat treatment is carried out at temperatures for example of about 750–850° C.

The content of cyanide in the fused bath may for example be from about 2 to 15%, preferably about 4 to 10%. The content of barium halide may lie between about 10% and about 60%, preferably between about 30% and about 50%. Barium chloride may be employed alone or together with strontium chloride or calcium chloride or both. Suitable alkali salts are for example sodium chloride, potassium chloride or both. In suitable cases lithium chloride may also be incorporated with the fused bath as an addition which lowers the melting point.

By suitable choice of the halides and their bases, fused baths of desired low viscosity can be produced and in this way losses of material by adhesion of the fused bath to the files to be treated can be considerably reduced. The alkaline earth halides, for example barium chloride, apparently have the effect of preventing decarbonisation, counteracting undesired nitration and ensuring uniform results.

The following composition may be mentioned as an example of a fused bath according to the invention:

Example

	Parts
Barium chloride	50
Sodium chloride	20
Potassium chloride	30
Sodium cyanide	4–8

The content of cyanide, which diminishes in the course of working with the bath, is preferably maintained within suitable limits for example by periodic addition of fresh cyanide. The baths cannot be maintained for any considerable period in a condition suitable for operation simply by replacement of the cyanide used up. In fact if the content of alkaline earth halide falls below a certain limit, the effectiveness of the bath deteriorates. Hence provision must also be made for the replacement of the alkaline earth halide, especially when the effectiveness of the fused

baths diminishes. When the baths are employed for a considerable period their composition varies through formation of carbonate, for example sodium carbonate, which may reduce the effectiveness of the fused bath when the carbonate content increases above certain limits, especially if at the same time the alkaline earth halide content of the bath has diminished. In general it is theerfore advisable to replace the baths from time to time by fresh additions.

Extensive practical experiments have shown that the lead baths previously employed can be completely replaced by the employment of baths which contain limited quantities of cyanide together with alkaline earth halide and alkali halide. Files are obtained in uniform yield of excellent hardness. A particular advantage of the process also consists in that it is extremely suitable for hardening files in series.

The application of protective layers, as was customary in the previously usual heat treatment of files in lead baths, may be omitted when working according to the above process.

CARL ALBRECHT.
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ALIEN PROPERTY CUSTODIAN

PROCESS FOR BLEACHING NATURAL AND ARTIFICIAL FIBRES AND FIBRES OF VEGETABLE ORIGIN AND FREE FROM INCRUSTATIONS

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No Drawing. Application filed January 13, 1939

The present invention relates to an improved process for bleaching natural and artificial fibres and fibre substances which are of vegetable origin and free from incrustations, for example cotton, linen, ramie, artificial fibres produced from regenerated cellulose, such as artificial silk or cellulose wool, or from cellulose esters or ethers, and products produced therefrom, such as yarns, mixed yarns, fabrics and the like, with the aid of bleaching agents yielding oxygen, such as hydrogen peroxide, sodium peroxide, perborate and others.

On bleaching fibres and fibre substances of the above mentioned kind such as cotton, linen, artificial silk, cellulose wool and the like, with bleaching agents containing active oxygen, the desired bleaching effect can occasionally not be obtained in spite of the employment of relatively high quantities of bleaching agents. Hence it is usual, when bleaching linen and similar fibre substances in peroxide baths, to subject the goods to an after-treatment by weak chlorination and acidification in order to remove the last yellowish traces. Similarly it is usual to subject cotton and cotton goods bleached with peroxide to further after-treatments, for example to treatment with hydrosulphite, acidification etc. so as to improve their appearance.

It has now been found that, when vegetable fibres of the type which is free from incrustations and products produced therefrom are to be bleached with bleaching agents giving off oxygen, the effects of the bleaching bath may be considerably improved without increase in the quantity of bleaching agents employed, if suitable quantities of alkali salts, including ammonium salts, of aliphatic polycarboxylic acids such as succinic acid, tartaric acid, citric acid, maleic acid are incorporated in the baths. Alkali salts of oxalic acid have proved particularly suitable. Relatively small quantities of the said salts suffice for obtaining the improved bleaching effects, for example from about 3 to about 6 gms per litre of bleaching bath, or if desired somewhat more. Instead of or in addition to alkali or ammonium salts, free carboxylic acids may also be added to the alkaline bleaching baths, for example to baths produced from sodium peroxide, and the salts improving the bleaching effect of the baths may be produced in desired quantities from these carboxylic acids.

According to the invention, baths containing alkali salts of polycarboxylic acids may be employed for bleaching vegetable fibres and fibre substances of the type which are free from incrustations, the normally usual or necessary after-treatments such as chlorination, treatment with hydrosulphite, acidification and the like being omitted. When, for example, linen is bleached according to the above process it comes out of the peroxide bath so clear and white that the previously usual subsequent chlorination and acidification is superfluous. Similarly, when bleaching cotton by the above process, so pure and clear a white is obtained that the previously usual after-treatments, such as hot soaping, hydrosulphite treatment, acidification and the like may be omitted.

Bleaching baths which, in addition to oxygen-yielding substances and if desired other substances, also contain salts of oxalic acid or alkali salts of polycarboxylic acids are known per se. It is, for example, known to employ oxalate-containing baths for bleaching animal fibres, such as wool. It is further known to bleach straw, i. e., a heavily incrusted vegetable material, with peroxide baths which contain large quantities of oxalate. Nevertheless it has not hitherto been suggested, nor was it evident to those skilled in the art that fibres and fibre substances of vegetable origin of the type which is free from incrustation could be bleached by employing oxygen-containing baths containing definite quantities of alkali oxalate and the like, the hitherto usual after-treatments being omitted, nor that a bleached product of entirely satisfactory character could be obtained by such a process. It was not to be expected that on bleaching vegetable fibrous substances of the type which is free from incrustation and which possesses considerable resistance to alkali and which in general is also bleached with alkali baths, special effects would be obtained by addition of organic salts of the kind specified. It was therefore all the more surprising that the presence of even relatively small quantities of oxalate or like salts should produce such particularly favourable effects; this fact can only be explained by the hypothesis that in this case it is a matter of different processes than in straw bleaching or in the bleaching of animal fibres. It seems as if certain impurities of the fibre, which cannot be destroyed or removed by the oxidising action of the bleaching agent, are dissolved or rendered innocuous by the presence of oxalate or the like in the bath. The behaviour of certain fibres produced from viscose which, apparently because of the presence of non-bleachable impurities coming from the manufacturing process, cannot or can only with difficulty be bleached by use of an oxygen or chlorine

bleach, is for example characteristic. Such fibres can be bleached according to the present process with excellent results, probably because the non-bleachable impurities are dissolved out, or rendered innocuous in other manner, by the action of the salt, for example alkali oxalate, added to the bath.

In order that the invention may be well understood the following examples thereof are given by way of illustration only.

1. 200 gms of cotton yarn are treated for 4 hours at 85–90°C in 1200 ccs of a bleaching bath which contains per litre:

H_2O_2 40%	ccs	4
Caustic soda	gms	2
Waterglass 38–40° Bé	ccs	4
A wetting agent produced by proteolysis, known by the trade name "Lampeon A"	gm	1
Sodium oxalate	gms	5

A control sample treated without addition of sodium oxalate come out of the bleaching bath dirty and grey, whilst the sample bleached with addition of oxalate had a much clearer and cleaner appearance.

2. 200 gms of linen yarn No. 20 are treated according to the following directions:

(*a*) Scald in 1200 ccs of scalding bath containing 20 gms of soda and 1 gm of caustic soda for 5 hours at 90° and then soak.

(*b*) Chlorinate in 1200 ccs of chlorinating bath with 7 gms of active chlorine per litre for 2 hours at 18°C and then soak.

(*c*) Acidify with 1200 ccs of an acidification bath containing 2 ccs of sulphuric acid 66° Bé. and 1 gm of sodium bisulphate per litre for ½ hour, then soak.

(*d*) Peroxide bath: 1200 ccs bleaching bath containing per litre

I. With oxalate

5 gms. sodium peroxide	=6.7 gms. sodium oxalate per litre
6 gms. crystallised oxalic acid	
4 ccs. waterglass 38–40° Bé.	

II. Without oxalate

Sodium peroxide	gms	5
Sulphuric acid 66° Bé	gms	4.81
Waterglass 38–40° Bé	ccs	4

Treatment for both samples: 3 hours at 75°C, 3 hours at 80°C, then rinse.

Result: Sample I (with oxalate) is a clearer and purer white than sample II (without oxalate) which has a yellow appearance. Sample II must be further weakly chlorinated and acidified in order to be as white as I.

3. 200 gms of cellulose wool fabric (viscose cellulose wool) are undressed and then treated for 5 hours at 75–80°C in 100 ccs of a peroxide bath which contains per litre

H_2O_2 40%	ccs	3.6
Caustic soda	gm	1
Waterglass 38–40° Bé	ccs	4
Sodium oxalate	gm	5

and finally rinsed.

A control sample treated without addition of sodium oxalate shows a considerably worse bleaching effect.

The sample bleached with addition of sodium oxalate was perfectly bleached.

4. 200 gms of artificial silk yarn (viscose were treated for 3 hours at 70°C in 200 ccs of a bleaching bath consisting of

		Per liter
H_2O_2 40%	ccs	3
Sodium pyrophosphate	gms	3
Sodium succinate	gms	5

and then rinsed. The bleaching effect was very good.

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KARL VIEWEG.

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ALIEN PROPERTY CUSTODIAN

SYSTEM OF TELEVISION IN COLOURS

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Application filed January 14, 1939

The object of my invention is a colour television system which does not require between the transmitting and receiving television stations a metallic line or a radio-link transmitting effectively a band of frequencies much larger than the band required for an ordinary black and white television. Instead of transmitting over said line or radio link, for each point of the object to be shown at distance, three signals on three different channels (that is the three brightness values of the three basic components (say blue, red and yellow) of the colour of said point), like in the colour television systems already known, I transmit only one signal I on one channel only, said signal carrying both the brightness and the colour,—or I transmit two signals I and I′ on two channels (one signal for the brightness and one signal for the colour). My invention permits either an economy in the cost of the metallic line, or a less congestion of the other in case of a radio link. Moreover my invention permits the privacy of television transmission (or secret televisional transmissions.)

The principle of my invention is illustrated in Figure 1, where 1 is the object or scene to be shown at distance; 2 is a scanning device producing for each point of the object 1, three elements or magnitudes A, B, C, characterising the mean brightness and the actual colour of said point; 3 is a coding device which combines the three elements A, B, C in one electric signal I (or two electric signals I and I′) transmitted to the distant station over the metallic line or radiolink 4. There the decoding device 5 restores the characteristic elements A, B, C which act on the television receiver 6 to produce on the screen 7 a coloured luminous point having the same position, mean brightness and actual colour than the point of the object 1 scanned at that instant in the transmitting station, so that the image of object 1 is reproduced on screen 7 both in shape and in colours.

In a first embodiment of my invention, the three characteristic elements A, B, C are respectively the brightness values of the three basic components (for example, blue red and yellow) of the coloured point of the object which is scanned at the considered instant.

In a second embodiment of my invention, the three characteristic elements A, B, C are: 1°—the mean brightness of said point, that is: the signal which would be sent in an ordinary black and white television system; 2°—the position in the visible spectrum of the radiation or wavelength which should be mainly absorbed in said visible spectrum in order to reproduce the actual colour of said point, 3°—the "degree of saturation" of the actual colour of said point, that is: the proportion of white to be added to an appropriate monochromatic colour (complementary to said most absorbed radiation) in order to reproduce said actual colour of said point.

In a third embodiment of my invention based on Maxwell's triangle of colours, the three characteristic elements A; B, C are: 1°—the mean brightness of said point, as above;—2°—the "hue" or predominating monochromatic colour corresponding to said point,—3°—the "degree of saturation" of the actual colour of said point.

In the first embodiment of my invention, I transmit generally on the line or radiolink one signal I only for each point of the object to be shown at distance, said signal I combining the three elements A, B, C.

In the second and third embodiments, I may transmit on one channel a signal which is precisely proportional to element A (thus giving an image in black and white) and on another channel a signal I′ combining the elements B and C (thus adding coloured touches to said image in black and white). In such a case I need two channels on the metallic line or radiolink, but the ordinary television receivers can then be still generally used for providing black and white images, whereas, in some receivers only, an attachment for adding colours to said images is used. However in the second and third embodiments of my invention, I may also combine the three elements A B C in one signal I, so that one channel only will be required on the metallic line or radiolink.

The appended drawings illustrate examples of realisation of my invention, but any other form of realisation embodying other features well known in the television art should be considered as contained in the frame of my invention.

Figure 2 illustrates the first embodiment mentioned hereabove and Figure 3 shows the coding screen E and the decoding screens E'_r E'_b E'_j.

Figure 4 illustrates an application of the second embodiment of my invention in which the modulation of the colour at the television receiving station utilizes the "chromatic polarisation" or the "dispersion of optical rotatory power for various wave lengths" associated with the Kerr effect electrically controlled, or with the electric accidental birefringence of a crystal, or with the Verdet effect magnetically controlled (magnetic optical rotation).

Figures 5 and 6 illustrate the transmitting television station in the second embodiment of my invention, in which the spectral curve of the actual colour of each point of the object to be shown at distance (curve shown in Figure 8) is automatically drawn, and in which the coding screen of Figure 7 is used. Figure 7–*a* shows another coding screen for a simplified transmitting station on the principle illustrated by Figures 5 and 6.

Figure 9 illustrates the Maxwell's triangle of colours and Figure 10 a graphic construction in said triangle, whereas Figure 11 illustrates the transmitting station in the third embodiment of my invention which is based on said Maxwell's triangle and in which the coding screen shown in Figure 12 is used.

Figure 13 illustrates a television receiving station using cathode ray oscillographs and Figures 14 *abc* and 15 *abcde* show the performance of the devices controlling said cathode ray oscillographs.

On Figure 2, S is the coloured object to be shown at distance, Ω an objective (or lens) having a rear diaphragm in the pupilla of which is located a trihedral mirror M giving three images of S (through a blue screen *fb*, a yellow screen *fj* and a red screen *fr*), said images being located respectively on the photosensitive mosaics *mb*, *mj* and *mr* of three iconoscopes I*b*, I*j*, I*r*, the anodes of which are *ab*, *aj*, *ar*, and the collecting plates of which are *cb*, *cj*, *cr*. The three electric voltages obtained at a given instant across the terminals of resistances *rb*, *rj*, *rr*, are proportional to the brightness values A, B, C of the blue, yellow and red basic components of the actual colour of the point of object S being scanned at that instant.

These three characteristic elements ABC are combined in the coding device COD comprising: 1°—a cathode ray oscillograph C (with a fluorescent screen F*l* and three deflecting coils B_b, B_j, B_r energized by elements A, B, C through three amplifiers A_b, A_j, A_r—2°— transparent coding screen E,—3°—a lens L condensing all the luminous rays produced by the luminous spot on F*l* through E,—4°—a photoelectric cell P*h*, giving across the terminals of its output resistance R a voltage I which constitutes the coded signal transmitetd over the metallic line of radio link LI.

At the distant television station, said signal I acts on a decoding device DEC comprising: 1°—three cathode ray oscillographs C'*b* C'*j* C'*r* with fluorescent screens and deflecting coils B'*b* B'*j* B'*r*;—2°—three transparent decoding screens E'*b* E'*j* E'*r*, located in front of said fluorescent screens; 3°—three lenses L'*b* L'*j* L'*r* condensing all the luminous rays produced by the three luminous spots of oscillogdaphs C'*b* C'*j* C'*r* through E'*b* E'*j* E'*r* respectively in three photoelectric cells P'*b* P'*j* P'*r*.

The three electric voltages obtained at the given instant across the terminals of the output resistances *r'b*, *r'j*, *r'r* of said photolecertic cells reproduce the three elements ABC of the actual colour of the point of object S being scanned at said instant in the television transmitting station; these three voltages are applied to the control grids of three cathode ray oscillograhs O*b* O*j* O*r* with fluorescent screens in front of which are located respectively a blue screen *f'b*, a yellow screen *f'j* and a red screen *f'r*. Three objectives or lenses Ω'*b* Ω'*j* and Ω'*r* associated with a collecting lens L'' superpose on the receiving screen S' the three basic images (blue, yellow and red) of object S.

For the simplicity of explanation, let us assume that the electric voltage T*r* (across r_r) may have one of three values $R_1=0$ (absence of red, R_2 (mean proportion of red), R_3 (large proportion of red),—that the voltage T_b across r_b may have one of three values, $B_1=0$ (absence of blue), B_2 (mean proportion of blue), B_3 (large proportion of blue),—that the voltage T_j across r_j may have one of four values $J_1=0$ (absence of yellow), J_2 (small proportion of yellow), J_3 (mean proportion of yellow), J_4 (large proportion of yellow). Let us assume also that the combination R_3 B_3 J_4 corresponds to white whereas the combination R_1 B_1 J_1 corresponds to black. Let us assume that the gains of the amplifiers A_b A_j A_r are adjusted in such a way that the luminous spot on fluorescent screen F*l* is just in front of the square of the transparent coding screen E (Figure 3) which has the same number as the compartment of the following coding table which contains the combination of the values of R, B, J existing at the same instant. For example when $T_r=R_2$ $T_b=B_2$ $T_j=J_4$, said luminous spot is in front of square N*r* 32 of the coding screen E, corresponding to compartment N[r] 32 in the following coding table).

Coding table

1 R_1 B_1 J_1	2 R_2 B_1 J_1	3 R_3 B_1 J_1	4 R_1 B_2 J_1	5 R_2 B_2 J_1	6 R_2 B_2 J_1	7 R_1 B_3 J_1	8 R_2 B_3 J_1	9 R_3 B_3 J_1
10 R_1 B_1 J_2	11 R_2 B_1 J_2	12 R_3 B_1 J_2	13 R_1 B_2 J_2	14 R_2 B_2 J_2	15 R_3 B_2 J_2	16 R_1 B_3 J_2	17 R_2 B_3 J_2	18 R_3 B_3 J_2
19 R_1 B_1 J_3	20 R_2 B_1 J_3	21 R_3 B_1 J_3	22 R_1 B_2 J_3	23 R_2 B_2 J_3	24 R_3 B_2 J_2	25 R_1 B_3 J_3	26 R_2 B_3 J_3	27 R_3 B_3 J_3
28 R_1 B_1 J_4	29 R_2 B_1 J_4	30 R_3 B_1 J_4	31 R_1 B_2 J_4	32 R_2 B_2 J_4	33 R_3 B_2 J_4	34 R_1 B_3 J_4	35 R_2 B_3 J_4	36 R_2 B_3 J_4

The transparence of the coding screen E increasing regularly from the square N[r] 1 (completely opaque) to the square N[r] 36 (completely transparent), the electric voltage I produced across the terminals of the output resistance R, after the photoelectric cell P*h*, is proportional to the number of the square in front of which said luminous spot is located at a given instant. This signal I characterising the particular combination of red, yellow and blue which corresponds to the actual colour of the point of object S being scanned at that instant, is transmitted over the metallic line or radiolink LI to the receiving television station where said signal I acts simultaneously on the cathode rays of the three oscillographs C'*b* C'*j* C'*r* in the decoding device. The decoding screens E'_b E'_j E'_r (Figure 3) are opaque except along the line explored by the luminous spot of the corresponding oscillograph, where they have a certain number of more or less transparent squares: on E'_r there are 36 squares in 12 series of 3 (squares **1** completely opaque and corresponding to R_1, squares **2** half transparent and corresponding to R_2, squares **3** completely transparent and corresponding to R_3),—on E'*b* there are 12 squares in 4 series of 3 (squares **1** completely opaque and correspond to B_1, squares **2** half transparent and corresponding to B_2, squares **3** completely transparent and corresponding to B_3),—on E'*j* there are 4 squares marked **1**, **2**, **3**, **4** and the

transparence of which is regularly increasing (square 1 being completely opaque and corresponding to J_1, whereas square 4 is completely transparent and corresponds to J_4).

Consequently for each value of signal I, the electric voltages across the terminals of the output resistances r'_b r'_j r'_r have the values t_b, t_j and t_i, indicated in the following decoding table:

Decoding table

Numbers proportional to the electric voltage I applied on line or radio link LI	Voltage t_r modulating the red component in the received image	Voltage t_b modulating the blue component in the received image	Voltage t_i modulating the yellow component in the received image
1	1	1	1
2	2	1	1
3	3	1	1
4	1	2	1
5	2	2	1
6	3	2	1
7	1	3	1
8	2	3	1
9	3	3	1
10	1	1	2
11	2	1	2
12	3	1	2
13	1	2	2
14	2	2	2
15	3	2	2
16	1	3	2
17	2	3	2
18	3	3	2
19	1	1	3
20	2	1	3
21	3	1	3
22	1	2	3
23	2	2	3
24	3	2	3
25	1	3	3
26	2	3	3
27	3	3	3
28	1	1	4
29	2	1	4
30	3	1	4
31	1	2	4
32	2	2	4
33	3	2	4
34	1	3	4
35	2	3	4
36	3	3	4

The perfect correspondence between the above coding table and decoding table, shows that, if the voltages t_r, t_b and t_j are applied to the grids g_r g_b g_j of the three cathode-ray oscillographs O_r O_b O_j, and if the images of the fluorescent screens of these three oscillographs through red screen f_r, blue screen f_b and yellow screen f'_j are well superposed on screen S' the image of object S will be well reproduced on S', both in shape and in colours.

Naturally, in practice, instead of having on the coding screen E and on the decoding screens E'_b E'_j E'_r (Figure 3) a finite number of squares, I utilize continuous gradations of increasing transparence (corresponding to the hereabove mentioned series 1 to 36, 1 to 3 and 1 to 4) so that I obtain a very great variety of colours in the images received on screen S'. I may also change at will the law of variation of the transparence of the various parts of the coding screen E, and use corresponding decoding screens E'_r E'_b E'_j, in order to secure the privacy of the television transmission (in black and white, or in colours).

In the coding device of Figure 2, I may also place the photoelectric cell Ph and the coding screen E within the cathode ray tube C, on the same mounting than the fluorescent screen Fl; and I may do the same in the decoding device for P'_b E'_b C'_b or P'_j E'_j C'_j or P'_r E'_r C'_r.

Instead of using photoelectric cells in these devices, I may utilize an emission of secondary electrons, and so avoid the intermediate transformation in light; in such a case the coding and decoding screens (E, E'_b, E'_j, E'_r) are mosaics of juxtaposed elements of emitting and non emitting materials, swept by the beam of cathode rays which produces a more or less intense flux of secondary electrons, said electrons being concentrated by appropriate "electron optics" on a collecting electrode connected to the output resistance (R, r'_b, r'_j or r'_r).

I may also place the whole decoding device in the same vacuum tube (instead of three separate tubes C'_b C'_j C'_r) using "cylindrical electron optics."

In Figure 4, the object to be shown at distance is represented in 1. 4, 4', 4'' are devices scanning synchronously three images (of said object 1) obtained through lenses 2, 2', 2'' and through a yellow screen 3, a purple screen 3' and a green screen 3'' respectively. At a given instant, electric voltages t_1, t_2, t_3, are obtained across the terminals of the output potentiometers 5' 5 5'', which are proportional to the brightness values of the purple (t_1), yellow (t_2) and green (t_3) components of the actual colour of the point of object 1 being scanned at that instant. In this case the coding device 6 is an "electrical differential arrangement" of three electrodes vacuum tubes combining these electric voltages t_1, t_2, t_3 together and producing a voltage T_m which characterises the wave-length of the radiation which should be mainly absorbed in the visible spectrum in order to reproduce the actual colour of said point of object 1. This voltage T_m, transmitted over the metallic line or radiolink 7 and amplified at the receiving station by amplifier 8 produces a voltage T''_m across the terminals of the Kerr cell 9.

The electrical differential arrangement 6 is such: 1°—that T''_m has a value T''_{mo} corresponding to colour No. 7 in the following table when (t_1-t_2) and (t_1-t_3) is positive, that is to say when the purple predominates in the actual colour of said point of object 1 which corresponds to a velocity difference of relative value 0 in the second column of said table; 2°—that, when (t_1-t_2) or (t_1-t_3) is negative, T''_m differs from T''_{mo} and in fact is larger than T''_{mo} if (t_3-t_2) is positive, and is smaller than T''_{mo} if (t_3-t_2) is negative; 3°—that the difference $(T''_m-T''_{mo})$ in the latter cases increases in absolute value rapidly when t_1 is small and more slowly when t_1 is large (see the column "Relative value of velocity differences" in the following table) because the purple colour corresponding to T''_{mo} is the most sensitive colour in such optical phenomena.

Nr of the colour	Relative value of the velocity difference produced by the Kerr cell 9	Most absorbed radiation	Colour obtained after anlyser 13
1	−259	Indigo	Light yellow.
2	−233	Blue	Bright yellow.
3	−135	Blue (greenish)	Yellow (orange).
4	−60	Green (bluish)	Orange (reddish).
5	−29	Pale green	Red.
6	−14	Green (yellowish)	Dark red.
7	0	Light green	Purple.
8	+10	Yellow (greenish)	Violet.
9	+24	Bright yellow	Indigo.
10	+99	Orange	Blue.
11	+163	Orange (brownish).	Blue-(greenish).
12	+182	Red (light carmine.	Green.
13	+261	Purple	Light green.

The Kerr Cell 9 in the television receiving station acts as a "modulator of colour." Inserted between polariser 12 (Glazebrook prism or the

like) and analyser 13 (Glazebrook prism crossed with 12) on the path of the luminous rays produced by source of white light 10 between lenses 11 and 14, said Kerr cell 9 produces a velocity difference in the luminous rays and acts like a crystal plate, the thickness of which would vary in accordance with the electric voltage T''_m applied between the electrodes of said Kerr cell 9. So the radiation most absorbed by said cell varies in accordance with column 3 of the above table when T''_m varies in such a way that the velocity difference varies itself in accordance with column 2; consequently the colour of the corresponding point of the image seen by eye 16 through the scanning device 15 varies in accordance with column 4 of the above table.

Instead of a Kerr Cell, I may use, for the modulation of the colour, a device utilising the electric or magnetic accidental birefringence of a crystal (quartz, Rochelle salt, etc.) or the magnetically controlled dispersion of the optical rotatory power (for various wave lengths) of a substance having a great Verdet effect (flint or silicoborate of sodium, carbon disulphide, arsenic trichloride, etc.).

Instead of using a purple screen 3', a yellow screen 3 and a green 3'', I may use screens of complementary colours (light green for 3', blue for 3 and red for 3''), the differential electrical arrangement 6 being then adjusted to produce an electric voltage T_m indicating which is the smallest among the voltages t_1, t_2, t_3 at each instant.

Figure 5 shows the optical arrangement and Figure 6 the electrical arrangement of the second embodiment of my invention, in which the spectral curve or diagram "energy-wave length" (Figure 8) of the actual colour of each point of object O is automatically drawn on the fluorescent screen *Fl* of the cathode-ray oscillograph OC within the coding device (Figure 6). The half transparent mirror *mt* (Figure 5) associated with lens L_1 and objective *ob* forms a first image of object O on the photosensitive mosaic *m* of a first iconoscope *i*, through a coloured screen *e* which has a curve of chromatic sensitivity inverse to the curve of chromatic sensitivity of said mosaic *m*. Consequently the electric voltage obtained at the output of iconoscope *i* (Figure 6), across the terminals of the output resistance *r'* of the amplifying vacuum tube L, is proportional to the mean ordinate T_m of the spectral curve of the colour of the point P of object O being scanned at a given instant.

The half transparent mirror *mt* (Figure 5) associated with the rotating prismatic mirror MT and the spectograph S (which slot is F) produces simultaneously on the photosensitive mosaic M of a second iconoscope I, the optical spectra of the colours of the various points of one line of object O, through a coloured screen E which has a curve of chromatic sensitivity inverse to the curve of chromatic sensitivity of said mosaic M. Consequently the electric voltage obtained at the output of iconoscope I (Figure 6), across the terminals of the output resistance R' of the amplifying vacuum tube L, is proportional to the various ordinates T_λ of the spectral curve of Figure 8 successively (energy e_λ corresponding to each wave-length λ in the actual colour of the point P of object O).

A synchronising device *Sy* synchronises the motion of the electric motor MMT (Figure 6) which rotates the rotating mirror MT (Figure 5) with the deflection of the cathode ray in iconoscope *i* (by means of deflecting coils b_h for horizontal sweeping of mosaic *m* and *bv* for vertical sweeping) and with the deflection of the cathode ray in iconoscope I (by means of deflecting coils B_h for horizontal sweeping and B_v for vertical sweeping of mosaic M). The horizontal sweeping of mosaic M being very rapid, I prefer to make it by means of a current in shape of double saw-tooth (isoseceles triangle) produced by a symmetrical relaxation oscillator having a period equal to twice the duration of the scanning of one point of object O. A retardating device DR (loaded artificial line for example) introduces a delay (equal to the duration of the scanning of one point of object O) for the current producing the vertical sweeping of mosaic M referred to the current of same wave shape which produces the horizontal sweeping of mosaic *m*. Consequently during the interval of time required by the electric voltage across resistance R' (Figure 6) to take successively the various values of T_λ (corresponding to the ordinates of spectral curve of the actual colour of point P of object O), the electric voltage across resistance *r'* keeps a constant value T_m which is precisely the mean ordinate of said spectral curve corresponding to the same point P of object O.

The electric voltages T_λ and T_m are applied in opposite directions to the deflecting plates KK_1 and $K'K'_1$ producing the vertical sweeping of the fluorescent screen *Fl* of cathode ray oscillograph OC, whereas the horizontal sweeping of said screen *Fl* produced by B'_h is synchronised with the horizontal sweeping of mosaic M. Consequently the luminous spot would draw on the fluorescent screen *Fl* a curve, the ordinates of which are proportional to the difference $(T_\lambda - T_m)$ whereas the abscissae are proportional to the wave-length λ (Figure 8). But the voltage T_λ is also applied to a condenser Q in series with a resistance *r''*, which is connected to the grid of a three electrode vacuum tube L''. Across the terminals of the output resistance R'' of said tube L'', I obtain a voltage equal to dT_λ/dt (*t* being time) which is applied to a controlling device M arranged in accordance with Figure 15—*a* and having a performance characteristic of the type represented on Figure 15—*c* (curve in shape of a "bell"); consequently when dT_λ/dt differs from zero, the voltage θ at the output of said controlling device M is always positive and, by means of the control grid G, suppresses the luminous spot on fluorescent screen *Fl*. On the contrary, when

$$\frac{dT\lambda}{dt}=O$$

that is for the minima and the maxima of the spectral curve (Figure 8), the luminous spot appears in its full brightness; finally on the screen *Fl*, alone the portions of said spectral curve represented in full line on Figure 8 appear luminous (that is only around the minimum *a* and the maximum *b*).

In this form of my invention the actual colour of the point P of object O being scanned is characterised by the wave-length corresponding to point *a* (most absorbed radiation) and by the "degree of saturation *s*" which is the ratio between the distance *sTm* of point *a* to the mean horizontal line H and the value *Tm* of the mean ordinate of the spectral curve (Figure 8). It is well known that, when the degree of saturation *s* decreases, that is to say when the proportion of white added to the monochromatic colour (corresponding to the actual colour of the considered point) increases, the minimum *a* of the

spectral curve gets nearer to the mean horizontal line H. For that reason, I use in the coding device of Figure 6 the coding screen E_1 represented on Figure 7, which is completely opaque on all the hatched part marked O, and which is progressively more and more transparent from square No. 1 to square No. 24. In this case, the coding table is the following:

Electric voltage T at the output of photo electric cell Ph in the coding device	Most absorbed radiation	Colour to be reproduced in the receiving television station	Degree of saturations of said colour
0	(All wave lengths equally absorbed.)	Black	----------
1	Violet	Yellow	1,00 à 0,75
2	Violet	Yellow	0,75 à 0,50
3	Violet	Yellow	0,50 à 0,25
4	Violet	Yellow	0,25 à 0
5	Blue	Orange	0 à 0,25
6	Blue	Orange	0,25 à 0,50
7	Blue	Orange	0,50 à 0,75
8	Blue	Orange	0,75 à 1,00
9	Green	Red	1,00 à 0,75
10	Green	Red	0,75 à 0,50
11	Green	Red	0,50 à 0,25
12	Green	Red	0,25 à 0
13	Yellow	Violet	0 à 0,25
14	Yellow	Violet	0,25 à 0,50
15	Yellow	Violet	0,50 à 0,75
16	Yellow	Violet	0,75 à 1,00
17	Orange	Blue	1,00 à 0,75
18	Orange	Blue	0,75 à 0,50
19	Orange	Blue	0,50 à 0,25
20	Orange	Blue	0,25 à 0
21	Red	Green	0 à 0,25
22	Red	Green	0,25 à 0,50
23	Red	Green	0,50 à 0,75
24	Red	Green	0,75 à 1,00

The electric voltage T, obtained at the output of the photoelectric cell Ph (Figure 6) in which are concentrated the luminous rays produced by the portion a only of the spectral curve (Figure 8) on the fluorescent screen Fl (Figure 6) through the coding screen E_1 and the lens Le, constitutes the signal I′ characterising the actual colour of each point P of object O, and is sent on the line or radiolink towards the receiving station.

Another voltage t, obtained also at the transmitting station and proportional to the mean brilliancy of said point P of object O, is sent also towards the receiving station. This voltage t (characterising the brightness value of point P in an ordinary black and white image) may be obtained by another iconoscope (not shown on Figures 5 and 6) in the ordinary way. But I may also obtain this voltage t across the terminals of resistance r' (Figure 6) if the screen e, combined with the mosaic m of iconoscope i, reproduces the curve of chromatic sensitivity of the human eye; in such a case the voltage Tm (mean ordinate of the spectral curve "energy-wave length") is obtained, from the voltage t, by means of a three electrode vacuum tube inserted between r' and $K'K'_1$ (Figure 6), the grid of which is controlled by the voltage at (existing across the terminals of deflection coil $B'h$), said voltage at being modified by a controlling device such as the one of Figure 15—a with a performance characteristic in shape of a bell, that is to say precisely the shape of the curve of chromatic sensitivity of the human eye.

Instead of using on Figure 6 the coding screen E_1 represented on Figure 7, I may use the coding screen E_1 represented on Figure 7—a, where the hatched portion marked O is black and completely opaque, whereas the portions marked 1 to 6 have an increasing transparence (from 1 to 6). The opaque portion O of screen E_1 (Figure 7—a) covering a portion of fluorescent screen Fl up to a height d above the horizontal diameter D, if the complete spectral curve is drawn on the fluorescent screen Fl (omitting on Figure 6 the circuit elements marked Q, r'', L″, R″, M, G), only the lower part of said spectral curve (corresponding to the most absorbed band of wave-lengths) will pass luminous rays through the coding screen, and the electric voltage T obtained at the output of photoelectric cell Ph will indicate then only the colour (and not the degree of saturation), which may be sufficient as a first approximation.

Figure 9 shows the Maxwell's triangle of colours in the form recommended by the International Illumination Commission in 1931. The position of point M, representing graphically a given colour, is defined by three "trichromatic coordinates" X, Y, Z, taken along the axis $z\ x$, $x\ y$ and $y\ z$ respectively in the direction of the arrow, with $X+Y+Z=1$. The center E of the triangle (located quite close to the point B representing the colour white) corresponds to a "spectrum of equal energy" (hypothetic source radiating the same energy for each wave-length).

In terms of $e_{\lambda n}$ (proportion of energy per second for wave length λ_n),

$$\bar{x}_n \bar{y}_n \bar{z}_n$$

(coefficients of distribution for stimuli of equal energy, or coordinates of the various points S on the curve representing the monochromatic colours inside the triangle of Figure 9), X, Y and Z are given by the following formulae:

$$X=\frac{\Sigma e_{\lambda n} x_n}{\Sigma e_{\lambda n}\bar{x}_n+\Sigma e_{\lambda n}\bar{y}_n+\Sigma e_{\lambda n}\bar{z}_n}$$

$$Y=\frac{\Sigma e_{\lambda n} y_n}{\Sigma e_{\lambda n}\bar{x}_n+\Sigma e_{\lambda n}\bar{y}_n+\Sigma e_{\lambda n}\bar{z}_n}$$

$$Z=\frac{\Sigma e_{\lambda n} z_n}{\Sigma e_{\lambda n}\bar{x}_n+\Sigma e_{\lambda n}\bar{y}_n+\Sigma e_{\lambda n}\bar{z}_n}$$

The area of the triangle on Figure 9 has been subdivided in six segments I, II, III, IV, V, VI corresponding respectively to violet-purple, blue, yellow, green, orange and red. Also dotted curves have been drawn, parallel to curve S, and marked respectively **0,25—0,50—0,75**.

The intersecting point S between the curve of monochromatic colours and the straight line E M (supposed in coincidence with the straight line B M) corresponds to the "hue" (or predominating wave-length in the spectrum of the actual colour represented by point M); the ratio

$$\frac{ME}{ES}$$

is equal to the "degree of saturation" of said actual colour, that is the ratio between the brightness of the hue and the total brightness in said actual colour.

The graphical construction of Figure 10 shows that the point M might be obtained in starting from the center E of the triangle: 1°—by means of a first displacement E P, in the direction of axis $z\ x$, equal to

$$-\frac{1}{3}=-\frac{X+Y+Z}{3}$$

followed by a second displacement P Q in the direction of said axis $z\ x$, equal to X.

2°—by means of a third displacement Q R, in the direction of axis $y\ z$, equal to

$$\frac{1}{3}=\frac{X+Y+Z}{3}$$

followed by a fourth displacement R M in the direction of said axis $y\ z$, equal to $-Y$.

Advantage is taken of this remark in the third embodiment of my invention, utilizing the transmitting television station shown schematically on Figure 11 and the transparent coding screen of Figure 12.

The iconoscopes Ix Iy Iz of Figure 11 have cathodes Tx Ty Tz in form of wires emitting electrons and the photosensitive mosaics Mx My Mz are swept vertically by rectilinear "electronic images" of said cathodes obtained by clindrical "electronic optics" not shown on the drawing.

An optical device (not shown completely on Figure 11) forms, on said mosaics Mx My Mz, through the spectographs Sx Sy Sz and the transparent screens Ex Ey Ez, the optical spectra of the actual colours of the various points of one line of the object O to be shown at distance (line being scanned at the given instant). The screen Ex has parallel vertical lines black (opaque) or gray (half transparent) or white (completely transparent): the vertical line of E_x corresponding to the vertical line of mosaic Mx allocated to wave-length λn has a transparence

$$S_n = \frac{\bar{x}_n}{\rho_n}$$

($\bar{x}_n$ being the trichromatic coordinate X for monochromatic radiation of wave length λ_n and ρ_n being the chromatic sensitivity of mosaic Mx for the wave length λ_n).

Similarly the screens Ey and Ez have vertical lines of transparences

$$\frac{\bar{y}_n}{\rho_n} \text{ and } \frac{\bar{z}_n}{\rho_n}$$

in front of the vertical lines of mosaics My and Mz allocated to wave-length λ_n ($\bar{y}_n$ and $\bar{z}_n$ having been defined hereabove and $\bar{\rho}_n$ being the sensitivity of mosaic My (or mosaic Mz) for wave-length λ_n).

Consequently the electric voltages X, Y, Z obtained at a given instant at the output of the amplifiers Lx Ly Lz, connected respectively to the collecting plates Cx Cy Cz of iconoscopes Ix Iy Iz, are proportional to

$$\Sigma e_{\lambda n}\bar{x}_n,\ \Sigma e_{\lambda n}\bar{y}_n,\ \Sigma e_{\lambda n}\bar{z}_n$$

that is to say are proportional to the trichromatic coordinates of the point M representing in Maxwell's triangle the actual colour of the particular point of the object O being scanned at that instant.

These electric voltages X, Y, Z are added together in the common output circuit of three-electrodes vacuum tubes $L'x$ $L'y$ $L'z$, in shunt with tubes Lx Ly Lz.

The electric voltages X, Y, Z and

$$\frac{X+Y+Z}{3}$$

are applied to the deflecting plates **1**, **2**, **3**, **4** of the cathode ray oscillograph *os* of the coding device, as shown on Figure 11, in order to produce the four above mentioned displacements of the luminous spot on the fluorescent screen *fl* of said oscillograph *os* (plates 1 and 2 being perpendicular to the axis *zx* of Maxwell's triangle and plates **3** and **4** being perpendicular to the axis *yz* of said triangle). Consequently at a given instant the luminous spot of oscillograph *Os* has in said Maxwell's triangle precisely the position M representing the actual colour of the point of object O being scanned at that instant.

The coding transparent screen *e*, located in front of the fluorescent screen *fl* is shown on Figure 12; the hatched portion marked O is black (completely opaque) and the other portions have a transparence which increases regularly from portion No. 1 to portion No. 24. In this case, the coding table is the following:

Electric voltage T obtained at the output of the coding device, after photoelectric cell ph	Hue, or predominating monochromatic colour corresponding to the actual colour of the point being scanned	Degree of saturation of said actual colour
0	Black	
1	Violet	1,00 à 0,75
2	Violet	0,75 à 0,50
3	Violet	0,50 à 0,25
4	Violet	0,25 à 0
5	Blue	0 à 0,25
6	Blue	0,25 à 0,50
7	Blue	0,50 à 0,75
8	Blue	0.75 à 1,00
9	Green	1,00 à 1,75
10	Green	0,75 à 0,50
11	Green	0,50 à 0,25
12	Green	0.25 à 0
13	Yellow	0 à 0,25
14	Yellow	0,25 à 0,50
15	Yellow	0,50 à 0,75
16	Yellow	0,75 à 1,00
17	Orange	1,00 à 0,75
18	Orange	0,75 à 0,50
19	Orange	0,50 à 0,25
20	Orange	0,25 à 0
21	Red	0 à 0,25
22	Red	0,25 à 0,50
23	Red	0,50 à 0,75
24	Red	0,75 à 1,00

The electric voltage T, obtained at the output of the coding device after the photoelectric cell *ph*, in which are concentrated the luminous rays produced by the luminous spot on the fluorescent screen *fl* through the coding screen *e*, constitutes the signal I′ characterising the actual colour of each point of object O, and is sent on the metallic line or radiolink towards the television receiving station.

Another voltage *t*, obtained also at the transmitting station and proportional to the mean brilliance of each point of object O, is sent also towards the television receiving station. This voltage *t* (characterising the brightness value of a given point in an ordinary black and white image) may be obtained by another iconoscope (not shown on Figure 11) in the ordinary way. But I may also obtain this voltage *t* in adding three voltages equal to $g_x X$, $g_y Y$, $g_z Z$ produced at the output of three vacuum tubes L''_x L''_y L''_z (not shown on the drawing, but supposed connected in shunt to tubes L_x L_y L_z and tubes L'_x L'_y L'_z); the gains g_x, g_y, g_z produced by said amplifying tubes L''_x L''_y L''_z should take into account the shape of the chromatic sensitivity of the human eye, so that the sum $t = g_x X + g_y Y + g_z Z$ represents the mean brightness of the point of the object, whereas X, Y and Z are energies.

I may either use two channels on the metallic line or radiolink between the transmitting and receiving television stations, in order to transmit separately the signal I′ (or voltage T characterising the colour) and the signal I (or voltage *t* characterising the mean brightness)—or combine these two voltage T and *t*, before the origin of said line or radiolink, into a single coded signal, by means of a coding device such as COD of Figure 2,—a decoding device such as DEC of Figure 2 being used at the receiving station after the end of said line or radiolink. Said decoding device (DEC) would restore the electric voltages T and *t* separately at the receiving station.

Figure 13 represents a form of realization of

the receiving television station corresponding either to the transmitting television station shown on Figure 6 (second embodiment of my invention) or to the transmitting television station shown on Figure 11 (third embodiment of my invention).

Let us assume that a decoding device of the type shown on Figures 2 and 3 (devices not shown on Figure 13) has discriminated the electric voltage t characterising the brightness value of each point of the ordinary black and white image of the object to be seen at distance,—the electric voltage T characterising the colour (either the most absorbed radiation, or the "hue"=predominating radiation),—the electric voltage s characterising the "degree of saturation",—and the synchronising impulses τ.

The electric voltage T (characterising the colour) is applied to the input terminals of the devices C_b, C_j, C_r which control respectively the brightness of the cathode ray oscillographs C_b, C_j, C_r (producing respectively a blue image, a yellow image and a red image), by means of the control grids, g_f, g_j and g_r respectively.

Simultaneously the electric voltage t (characterising the mean brightness) is applied to the input terminals of device C_n controlling the brightness of the cathode ray oscillograph O_n (producing a black and white image), by means of the control grid g_n.

The electric voltages t (mean brightness) and s (degree of saturation) are applied to the input terminals of device C_s which controls the proportion of white light and of coloured light which are mixed on the projection screen E P, in order to reproduce the appropriate "degree of saturation," this control being made by means of the auxiliary control grids g'_n, g'_b, g'_j and g'_r.

The deflections of the cathode rays in oscillographs O_r, O_b, O_j, O_r are simultaneously produced by a device sy (with deflecting coils b) which is synchronised by the synchronising impulses τ transmitted by the corresponding television transmitting station; consequently at a given instant the 4 luminous spots on the fluorescent screens of oscillographs O_n, O_b, O_j, O_r have the same geometrical position in the image (black, blue, yellow, or red); an optical system represented schematically by lens L, concentrates and superposes the luminous rays emitted by said 4 luminous spots on the same point of the projection screen EP. Oscillograph O_n draws on screen EP the shape (in black and white) of the object O to be seen at distance, whereas the oscillographs O_b, O_j, O_r add to this drawing "coloured touches," the control grids g_b g_j g_r determining the colour of said coloured touches and the auxiliary control grids $g'n$ $g'b$ $g'j$ $g'r$ determining the degree of saturation of said coloured touches.

Let us consider for example the coding table given hereabove and corresponding to the transmitting television station of Figure 6 (second embodiment of my invention). To conform to this coding table, the controlling devices C_b C_j C_r must produce at their output terminals the following electric voltages T_b T_j T_r respectively applied to the control grids g_b g_j g_r when the voltage T is applied to their input terminals.

Value of the electric voltage T received from transmitting station (modulation of colour).	0	1 to 4	5 to 8	9 to 12	13 to 16	17 to 20	21 to 24.
Most absorbed radiation	All wave lengths equally absorbed.	Violet	Blue	Green	Yellow	Orange	Red.
Voltage T_b controlling the blue component	0	0	0	0	1	2	1.
Voltage T_j controlling the yellow component	0	2	1	0	0	0	1.
Voltage T_r controlling the red component	0	0	1	2	1	0	0.
Hue, or predominating monochromatic colour corresponding to the actual colour obtained on the projection screen at the receiving station.	Black	Yellow	Orange	Red	Violet	Blue	Green.

The above table shows that, when voltage T increases regularly from 1 to 24, each voltage T_b T_j or T_r should vary according to a law represented graphically by a curve in shape of a "bell" (like Figure 14—*b* or Figure 15—*d*) or of an "inverted bell" (like Figure 14—*c* or Figure 15—*c*), the top (or the bottom) of said "bell" being conveniently located along the T axis.

Devices having such a performance characteristic are shown, as examples, on Figures 14—*a* and 15—*a*.

Figure 14—*a* represents a three-electrodes vacuum tube, the grid of which is polarised in such a way that the curve giving the output voltage RI in terms of the input voltage T has the shape shown on Figure 14—*b* (dynatron effect). By means of a battery E (Figure 14—*a*), the other shape of curve shown on Figure 14—*c* (E—RI in terms of T) may be readily obtained.

Figure 15—*a* represents a three-electrode vacuum tube having the characteristic (RI in terms of T) shown on Figure 15—*b*. At the output of said tube is connected a Wheatstone bridge, two arms of which are high resistances of equal values, whereas the two other arms are copper-oxide rectifiers. Across the terminals of the resistance r, in the diagonal of said Wheatstone bridge, I have a uni-directional current, the intensity i of which is equal to zero when $T=T_0$ and rises always when T becomes larger or smaller than T_0; the maximum S_m of the voltage $S=ri$ is obtained for $T=T_1$ or $T=T_2$; consequently the performance characteristic of such a device shown on Figure 15—*a* has either the shape of the curve of Figure 15—*c* (S in terms of T) or of the curve of Figure 15—*d* (S_m—S in terms of T).

For the devices C_b and C_r producing the voltages T_b (control of the blue component) and T_r (control of the red component), an arrangement such as Figure 14—*a* or 15—*a* with a performance characteristic such as Figure 14—*b* or Figure 15—*d* is used according to the above table; for the device C_j producing the voltage T_j (control of the yellow component), I associate a device shown on Figure 15—*a* having the performance characteristic S of Figure 15—c with a pentode having the performance characteristic S' of Figure 15—*e*, in order to obtain a value T_j=o when T=o (black colour), in accordance with the above table.

In the case of the other coding table given

above and corresponding to the transmitting television station of Figure 11 (third embodiment of my invention), the controlling devices C_b C_j C_r would be arranged to respond to the "hue" [predominating radiation (or wave-length)] [and not to the "most absorbed radiation" (or wave length)], but they would also be made on the principles of Figure 14—*a* or Figure 15—*a*.

Although in the above described television stations cathode ray devices have been shown exclusively (iconoscopes for the transmission and oscillographs with fluorescent screens for the reception of television), the invention applies just as well to colour television installations using electromechanical scanning devices and any type of source of coloured light such as (1) ionic relays constituted by luminescent electrical discharge valves (gas or vapour) whose brilliance is controlled by means of a modulating electrode (2) incandescent lamps fitted with devices for modulating colour and brilliance, calling into play either chromatic polarisation with electric or magnetic double refraction (Kerr effect, accidental electrical double refraction of a piezoelectric crystal, etc.) or rotatory magnetic dispersion, or any other known electro-optical or magneto-optical phenomenon.

Finally I may use, for the coding or decoding device, a cathode ray commutator having a number of contacts (or studs) connected to different points of a scale of potentials in accordance with the signalling code adopted; the cathode rays beam, under the action of a deflecting coil (or deflecting plates) energized by the controlling current applied to the input terminals of said coding or decoding device, hits the proper stud, and consequently applies the proper electric voltage to the output terminals of said coding or decoding device.

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SYSTEM OF TELEVISION IN COLOURS

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6 Sheets-Sheet 1

Fig. 1

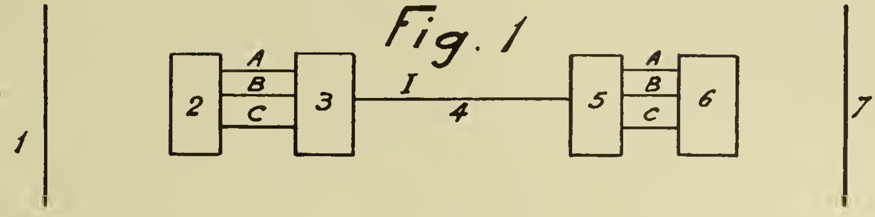


Fig. 3

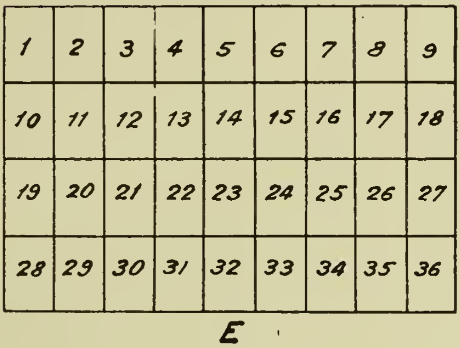
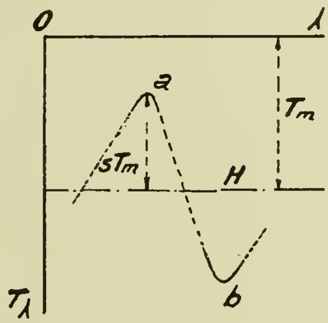


Fig. 8



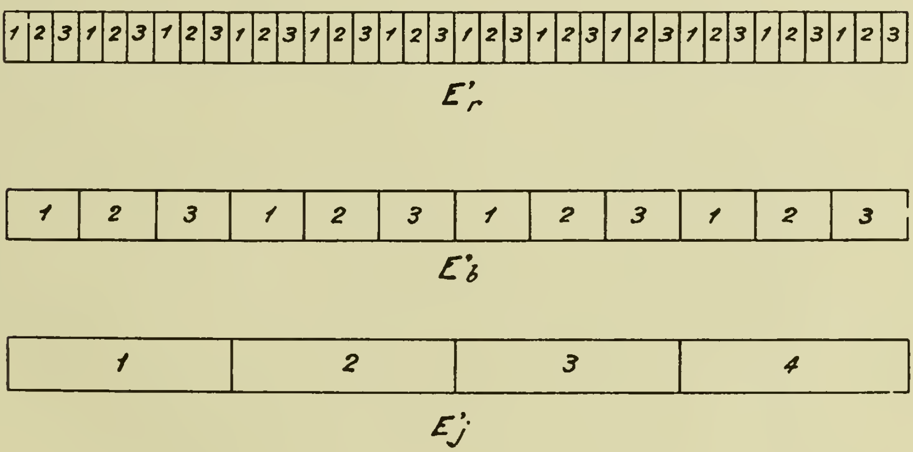


Fig. 7

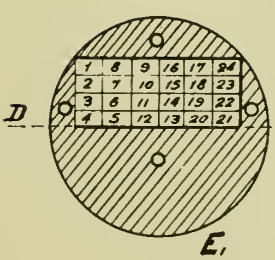
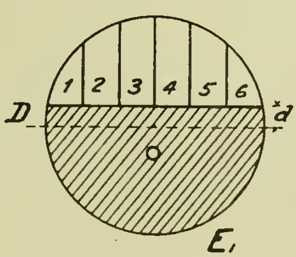


Fig. 7a



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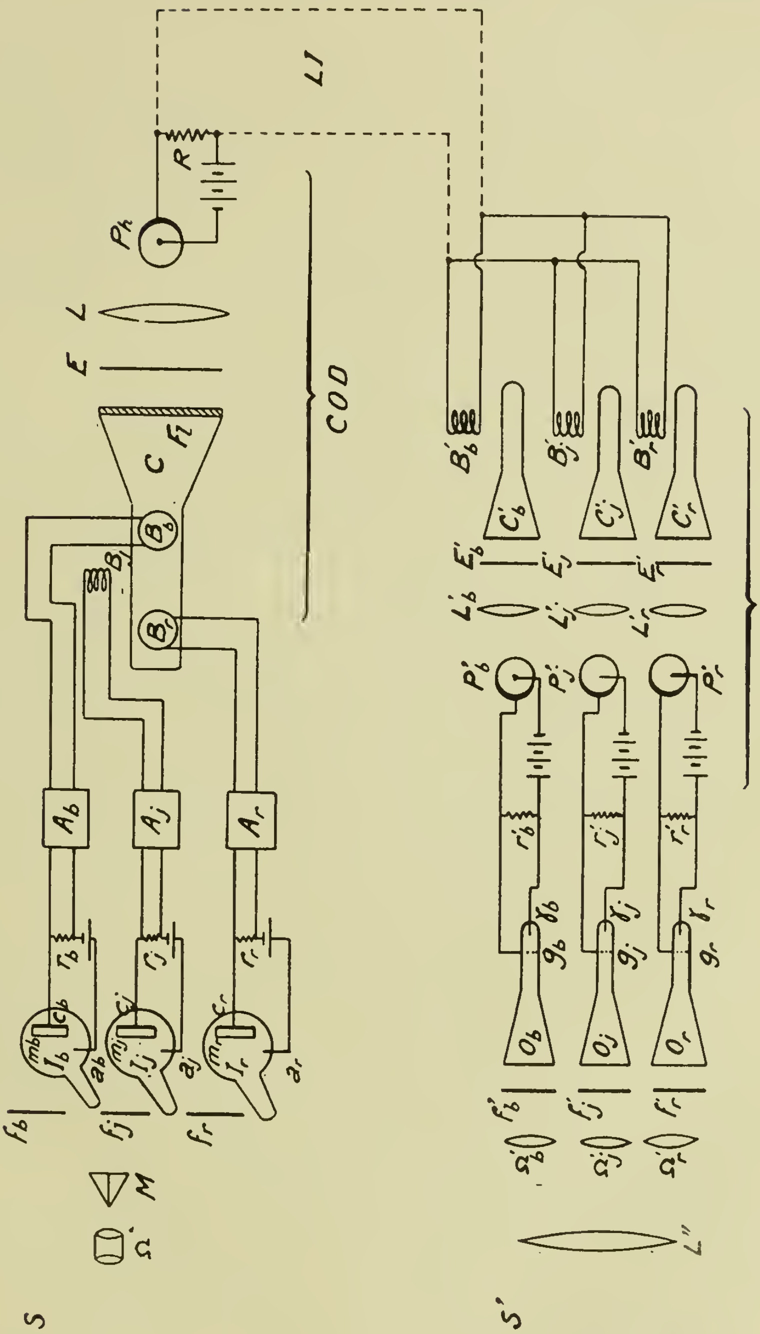
By [signature]

Attorneys

PUBLISHED	G. VALENSI	Serial No.
JULY 13, 1943.	SYSTEM OF TELEVISION IN COLOURS	251,004
BY A. P. C.	Filed Jan. 14, 1939	6 Sheets-Sheet 2

Fig. 2



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BY A. P. C.

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SYSTEM OF TELEVISION IN COLOURS
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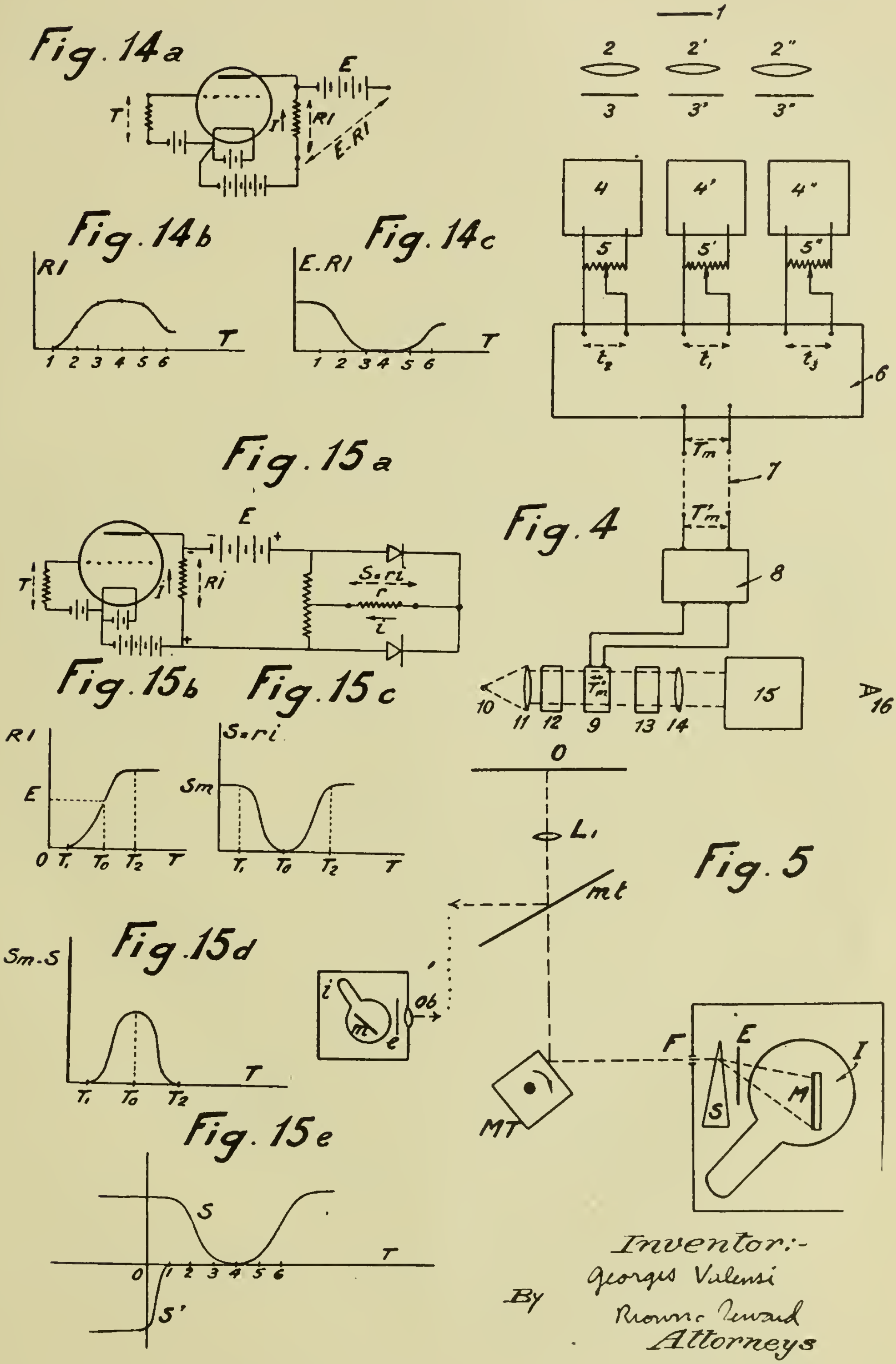
Serial No.
251,004
6 Sheets-Sheet 3



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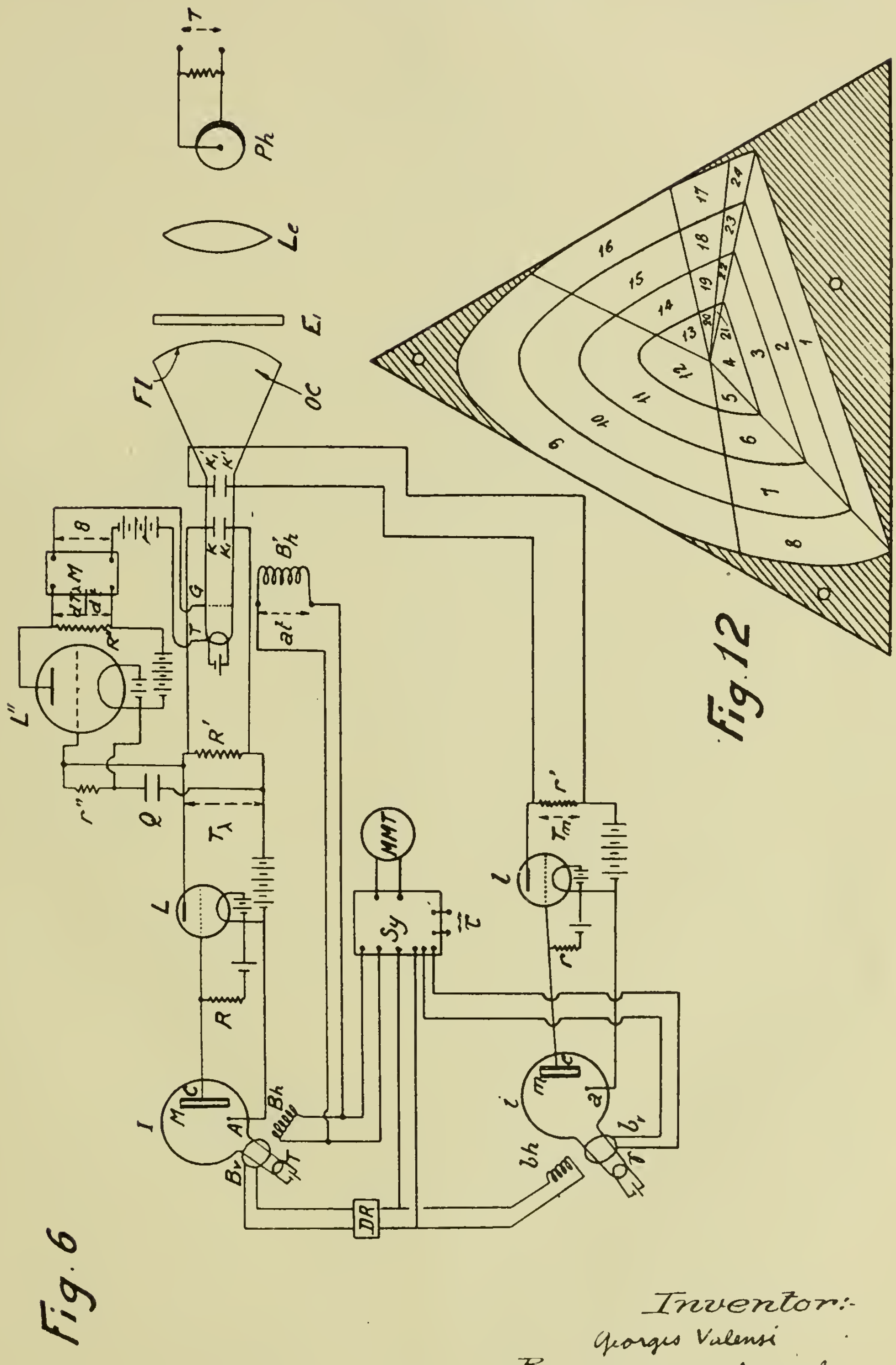
PUBLISHED	G. VALENSI	**Serial No.**
JULY 13, 1943.	SYSTEM OF TELEVISION IN COLOURS	**251,004**
BY A. P. C.	Filed Jan. 14, 1939	6 Sheets-Sheet 4



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G. VALENSI
SYSTEM OF TELEVISION IN COLOURS
Filed Jan. 14, 1939

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251,004
6 Sheets–Sheet 5

Fig. 9

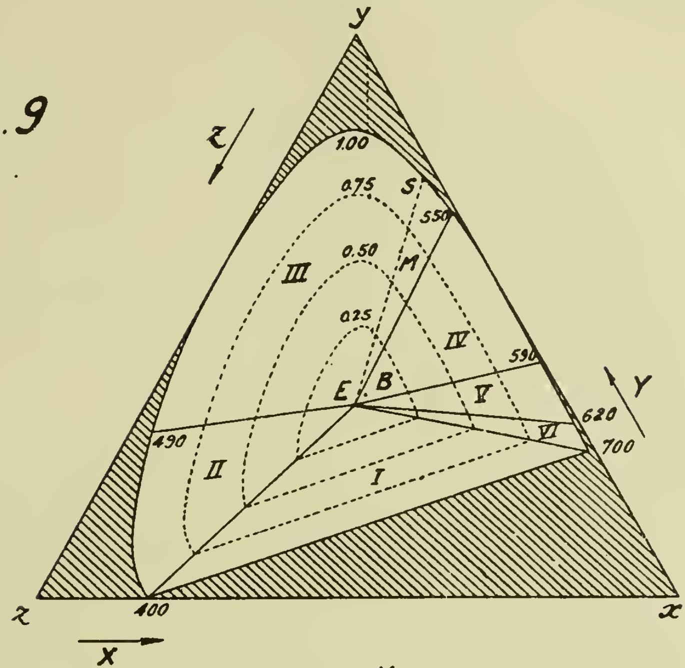
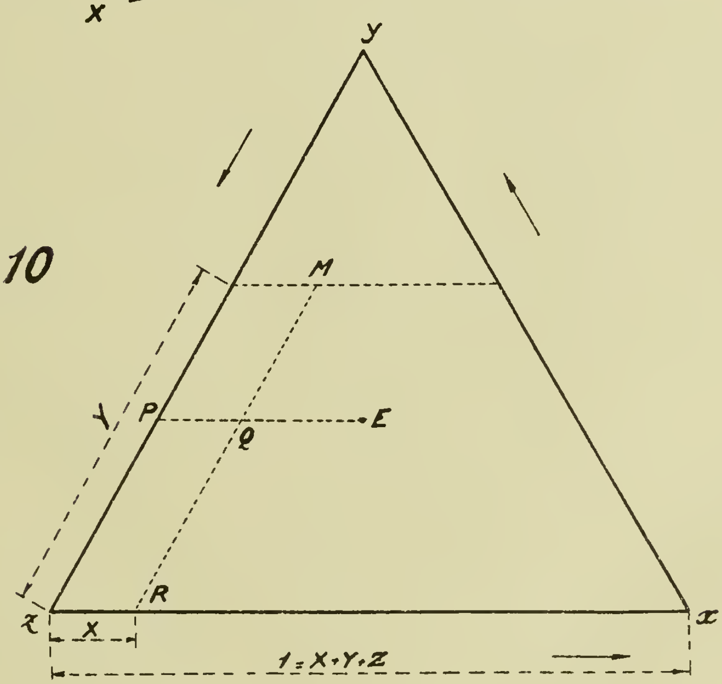


Fig. 10



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PUBLISHED
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BY A. P. C.

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Serial No.
251,004
6 Sheets-Sheet 6

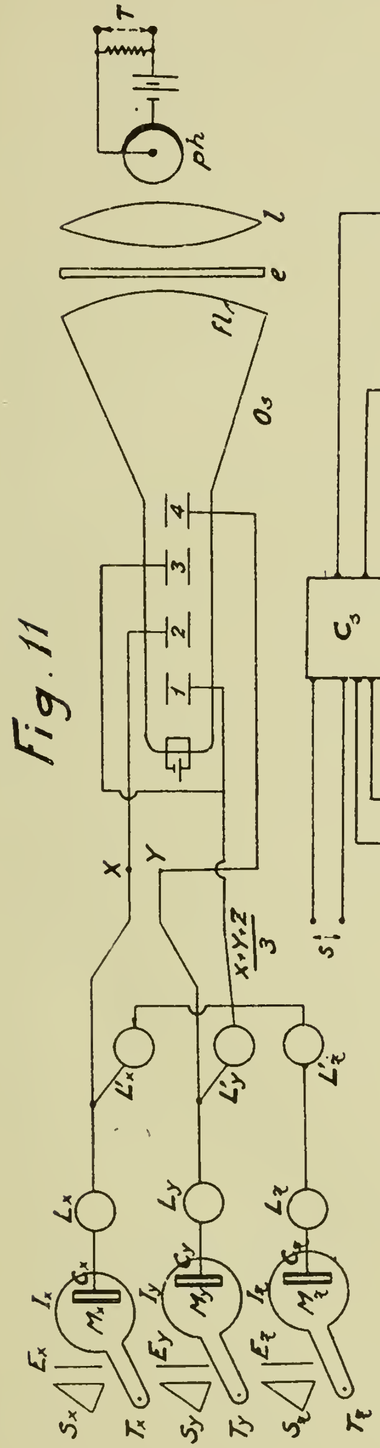

Fig. 11

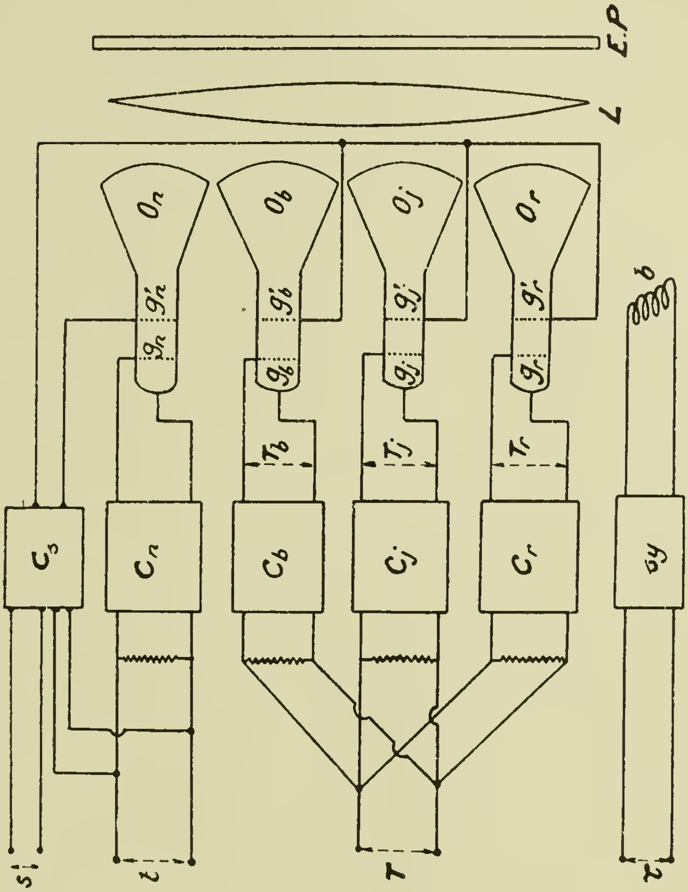

Fig. 13

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Published July 13, 1943 Serial No. 254,576

ALIEN PROPERTY CUSTODIAN

DEVICE FOR THE FORMING OF A TOBACCO ROD IN CIGARETTE MACHINES

Paul Johannes Herrmann, Dresden, Germany; vested in the Alien Property Custodian

Application filed February 4, 1939

The invention relates to a device for the forming of a tobacco rod for rod cigarette machines, in which the tobacco rod is formed in a groove provided in the periphery of a wheel rotating in a vertical plane over part of which a tobacco enclosing belt is placed.

The tobacco rod which is formed in the groove is conveyed by way of a bridge into the well-known shaper, in which it is provided with the tissue paper covering.

The transposition of the tobacco rod to the bridge has been accompanied with difficulties, and one of the objects of this invention is to provide means to overcome the same.

For this purpose, the invention consists of means cooperating with the tobacco rod as it leaves the groove of the wheel and enters upon the bridge, enabling the removal of the belt from the bridge, and its facile replacement over the bridge.

The invention has further for its object to separate from the belt as it passes over the bridge any adhering tobacco, and for this purpose the invention consists in means cooperating with the belt to separate adhering tobacco therefrom and discharge it to the bridge so as to enable it to form part of the tobacco rod as it is being enveloped by the paper.

The invention will be more fully described hereinafter, shown in the embodiments illustrated in the drawings, and will be finally pointed out in the claims.

In the accompanying drawings:

Figure 1 is a general side view, partially in vertical cross section, the drawing showing a broken off portion, as the structure of that part of the machine forms no part of the invention;

Figure 2 is a vertical cross section taken on line II—II of Figure 1, seen in the direction of the arrow applied to line II—II;

Figure 3 is an enlarged side view of the corresponding parts generally indicated in Figure 1, in respect to the movement of the end of the belt, bridge, and transposition of tobacco rod from the wheel to the bridge, and the supply thereto of the enveloping paper, together with the scraping device;

Figure 4 is a partial plan view of the tobacco rod as it leaves the groove of the wheel and of the bridge;

Figures 5 and 6 are vertical sections taken along the lines V—V and VI—VI of Figure 3, seen in the direction of the arrows applied to said lines; and

Figure 7 is a front view of the bridge, shown in Figure 4, with the belt roller applied thereto.

Similar characters of reference indicate corresponding parts throughout the various views.

Referring to the drawings, and more particularly to Figure 1, the structure there shown is known, and will not be described in detail, except as such old parts are necessary to point out the improvement.

The cigarette or tobacco rod conveyor belt **22**, paper **24** and former **22***a* act in the manner well known. The wheel **14** has a peripheral conduit **15** to form the rod by means of the belt **5**, which extends over the wheel **14** about one half of its circumference. The return of the belt **5** is over pulley rollers **16**, **17**, **18** and **19**, and then over a roller **7**.

As known, the tobacco is fed by the apron **1**, shown in Figure 2, which passes over the roller **2**, and the tobacco drops into a vertical and conical channel **3**. The tobacco discharges upon a U-shaped portion **4** of the belt **5**, this form being given to the belt **5** by its passage through the channel, shaped support **6**. The tobacco in this U-shaped form of the belt is conveyed to the wheel **14**, where the tobacco enters the groove **15**, and the belt flattens itself against the wheel **14**.

The improvement consists in the device provided for moving the uppermost end of the belt where it is bent back upon itself over the roller **16**, out of the path of the bridge **20**, to enable access to be had thereto, and in the adjustment of the belt at its lowermost end where it also doubles upon itself when passing over the roller **7**.

Referring to Figure 3, the tobacco rod formed in the groove **15** is removed therefrom by the guide plate **26** and **27** having a slot in which the bridge **20** is disposed. A plan view of this structure is shown in Figure 4. The rod of tobacco as it leaves the wheel **14** is maintained as a rod by the aid of the belt **5**, as it is extended from right to left in Figure 3 beyond the wheel **14** so as to enable the rod to be enveloped by the paper **24**, passing over the roller **25**, and thrusts the rod and paper into the former **22***a*. The rod enveloped by the paper is conveyed by the belt **22** passing over the roller **23**, to the knife (not shown).

This transposition of the rod to the former, as the rod emerges from the wheel, has given considerable trouble in the practical working of rod forming machines utilizing wheels and belts.

To enable ready access to be had to the bridge **20**, the belt extension from the roller **35** to the roller **16** is made so as to be capable of being lifted and put out of the way. For this purpose, in the

embodiment shown, the shaft 35 of the roller, in addition to acting as a shaft for the roller, acts to pivotally support two parallel bars 31 and 32, which in turn support the ends of the shaft 38 of the roller 16. Transversely to the free ends of the bars 31 and 32, and forming a closed frame therein, is a scraper device 28, and a deflecting extension 39. When it is desired to examine the bridge 20, the frame formed of the bars 31 and 32 and cross bar 33, with deflector 39, is moved on the pivot shaft 35, and raised to the position shown in dotted lines in Figure 3. Thereby access is had to the tobacco rod 15a, while being enveloped by the paper 24, to the former 22a, to the bridge 20, and to the surfaces 26 and 27, and to the wheel 14 with its groove 15. By thus turning the roller 16 up and rearward, the belt 5 becomes slackened, and for the purpose of taking up this slack, the roller 7 is made movable, as seen in Figure 1. The shaft of this roller 7 is journalled in a movable support or slide 8. Upon this support 8 are fish plates 9, between which and the plates 11 springs 10 are arranged, which pull the plates 9 constantly in the direction of the arrow there shown, the plates 11 being firmly fixed in the groove plate 6, (Figure 2). The slide 8 is held and guided by two guide pins 12 having heads, which pins are attached to the floor of the plate 6, and which project into a set-off and correspondingly long slot 13 of the silde. The extreme left of the tension roller is indicated by broken lines. Thus, when the roller 16 is moved up and back, and provides a slack in the belt, this slack is taken up by the movement of the roller 7 from full line position to dotted line position in Figure 1; and when the roller 16 is moved from dotted line position, as shown in Figure 1, to full line position, the roller 7 takes the full line position. The belt portions which traverse the groove 6 and which contact with the wheel 14, remain unaffected, the other portions of the belt adjusting themselves over rollers 17, 18 and 19.

In continuation of the groove 15 there is formed, in the region of the bridge 20, a channel whose floor consists of the bridge 20 and which has the width of the groove, as is apparent from Figure 4. The bridge 20 has an extension 21.

The surfaces 26 and 27 have together a width equal to the width of the wheel 14, as seen in Figure 4, and at their rod discharge ends are inclined upwardly, to the position where an adjustable scraper 28 rests against the belt 5 passing over the roller 16. Thereby the inner edges of the channel walls 26 and 27 move apart, so that there results a widening to the lines 29 and 30, as seen in Figures 4 and 6. At the same time, the edges are rounded off in the region of these lines. If the edges of the walls 26 and 27 were to extend perpendicularly upward, as is indicated in Figure 7 by broken lines, then the particles of tobacco scraped off from the belt by the wide scraper would not be completely conducted to the exposed tobacco rod, and also a contact with the belt resting upon the reversal roller 16 would always occur at the same place, i. e., in two concentric circles, a circumstance which would immediately lead to the destruction of the belt. But if a gradual widening along the lines 29 and 30 takes place, then a contact of the channel edges with the belt 5 running on the roller 16 occurs at points which are continuously changing, a fact which contributes materially to the preservation of the belt. The scraper 28 is in this comnnection constructed as wide as the unfolding of the edges of the channel permits, and in consequence thereof the scraper sweeps not only that portion of the belt which is situated in the region of the channel groove, which corresponds in its dimensions to the wheel 15, but also those portions of the belt which are situated to the sides thereof, so that any particles of tobacco which may possibly still adhere there are removed by the scraper.

The two side walls 31 and 32 have at their forward end a transverse strip 33, to which the scraper 28 is displaceably attached by means of screws 34, and to which the cap 39 is attached by means of screws 40. The bolt 35 is firmly supported in the machine frame. The side walls 31 and 32, which together with the transverse strip 33 form a swinging frame, have their lower ends resting on the machine frame 37 and thereby limit the swinging of the arm downward, (Figure 5). The arrangement is made in such a way that the center of the axis of rotation 38 of the reversal roller 16, when the latter occupies the operating position in accordance with Figure 3, is situated lower than the center of the bolt 35. By this toggle joint action, the roller 16 is normally held in down or operative position.

To the swinging frame there is expediently attached on the outside a handle, not illustrated in the drawing, which handle makes it possible to swing it upward against a stop, not shown, into the position indicated in Figures 1 and 3 in broken lines. The swinging frame is automatically held fast in the operating position by the tension of the belt, when the axis of roller 16 is below that of the roller 36.

It has been seen that the belt 5 has been drawn forward at the point of the removal of the tobacco rod. i. e., in the region of the upper vertex of the pulley, and provided with a guide roller, to such an extent that it overlaps the bridge 20 inserted between the pulley 15 and the shaper belt 22, in order thus to obtain a positive propulsion of the tobacco over the bridge 20 and to cover the bridge. At the point where the rod emerges from the groove 14 of the wheel 15, the belt 5 is conducted away from the bridge 20, this being a critical point which requires constant supervision and which must therefore above all things be readily accessible.

In this manner, by simple swinging of the end of the belt upward, one can expose the point of transfer of the rod, while at the swinging back the chosen mutual position of the swing axis to the center of the guide roller which has been swung into the operating position assures with certainty a correct and unshiftable position of the guide roller and therewith also of the belt to the bridge, because in consequence of the overpassing of the dead-point position the belt tension itself assures the holding fast of the swing lever in the operating position.

Now in order that, when the roller carrier lever is swung out of the operating position, the belt, whose length of path is thereby shortened, shall not become slack, the arrangement has been made, that the guide roller 7 at the other end of the endless conveyor belt 5 is displaceably pivoted on the machine frame and is fashioned by means of a spring as a tension roller.

In this manner a compensation takes place, which, however, extends only to that portion of the belt which serves for belt return from the upper terminal guide roller to the lower terminal guide roller, while the belt portion situated in the tobacco feed groove and also the belt por-

tion placed around the pulley are not touched by this compensation.

Also, a scraper is provided which acts against the belt situated on the roller to remove the particles of tobacco which may possibly have been carried along by the belt, and which is constructed broader than the tobacco rod groove, so that it can also remove particles of tobacco sidewise of the belt portion which covers the groove.

Furthermore, it has been seen that in the region of the bridge, and as far as the junction with the shaper conveyor belt, a channel has been provided, the floor of which is formed by the bridge **20**. At the point where the belt is led back over the roller carried by the swinging frame, the side walls of this channel, the surfaces **26** and **27** hereinabove set forth, are extended upward as far as the scraper. In accordance with the invention, however, these side surfaces, at the reversal point of the belt, commencing from the width of the channel, are gradually widened outward and are here rounded off, in which connection the widening is greater than the aforesaid width of the scraper. In this way the result is attained that the particles of tobacco, which are removed from the belt by means of the scraper over a greater width than that of the groove, are conducted from the widened side walls to the exposed tobacco rod, and furthermore, that at the point of reversal the belt is not subjected to rapid wear, as would be the case if the wall of the channel were continuously drawn upward in the width of the channel, in which case a friction would always take place on the belt in two concentric lines, whereas in this arrangement the drawn-apart channel boundary comes in contact with ever new belt portions.

I have described several embodiments of my invention, but it will be clear that changes may be made within the principles of the invention described.

PAUL JOHANNES HERRMANN.

PUBLISHED

JULY 13, 1943.

BY A. P. C.

P. J. HERRMANN

DEVICE FOR THE FORMING OF A TOBACCO ROD IN CIGARETTE MACHINES

Filed Feb. 4, 1939

Serial No. 254,576

2 Sheets-Sheet 1

Fig. 1

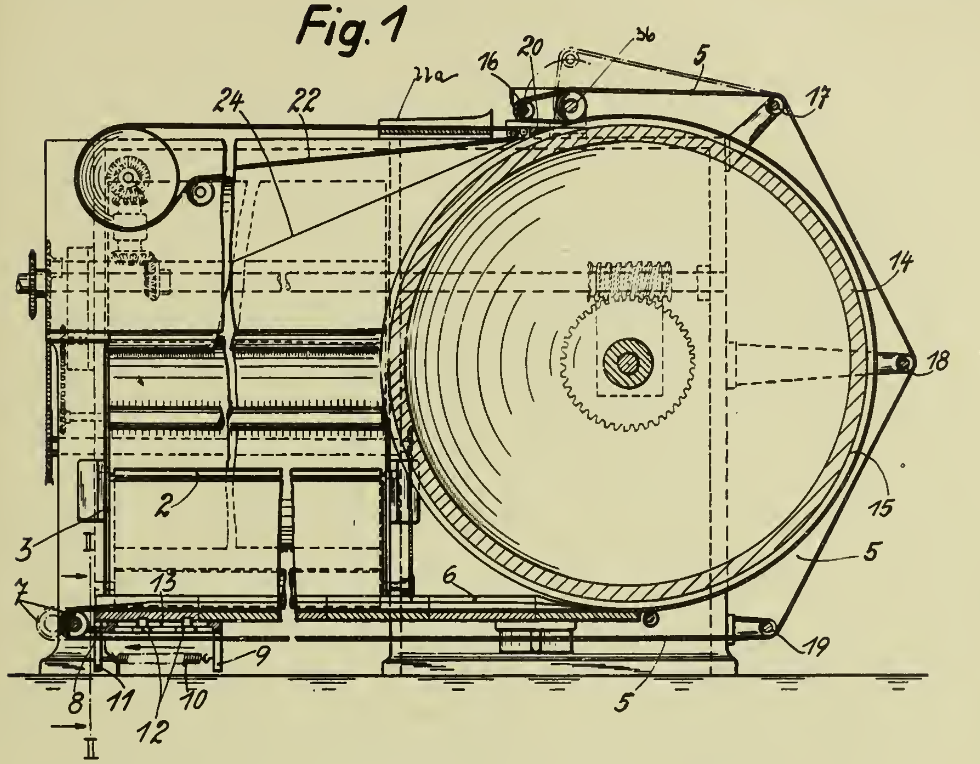
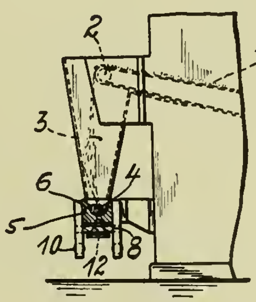


Fig. 2



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PUBLISHED

JULY 13, 1943.

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DEVICE FOR THE FORMING OF A TOBACCO ROD IN CIGARETTE MACHINES

Filed Feb. 4, 1939

Serial No. 254,576

2 Sheets-Sheet 2

Fig. 3

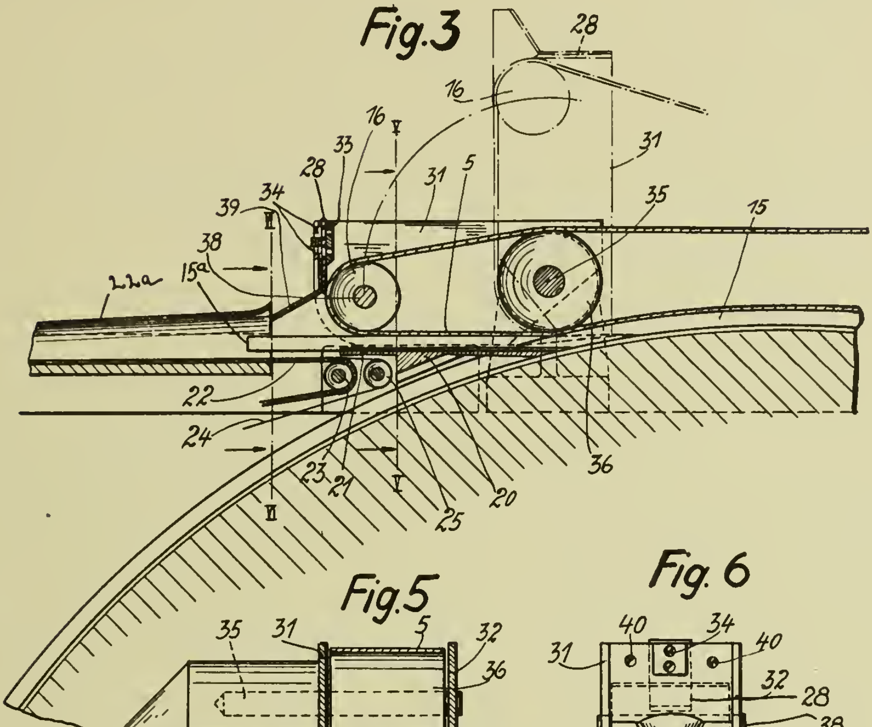


Fig. 5

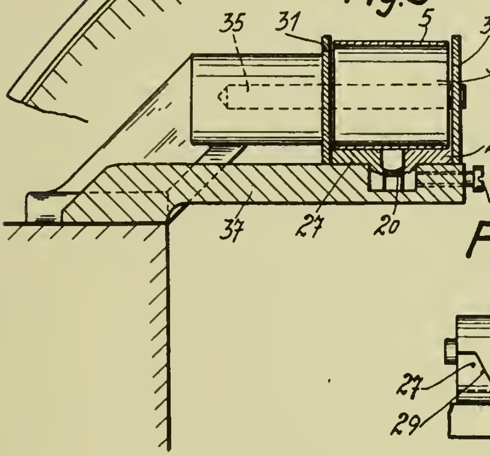


Fig. 6

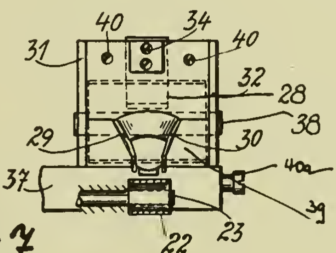


Fig. 7

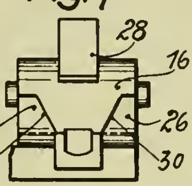
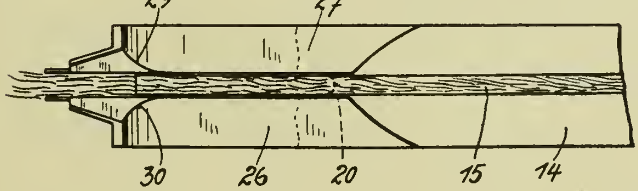


Fig 4



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ATTORNEY.

Published July 13, 1943

Serial No. 254,739

ALIEN PROPERTY CUSTODIAN

PROCESS FOR REDUCING VEGETABLES CONTAINING STARCH TO A DRY POWDER

Zelmanas Volpertas, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed February 4, 1939

There already exist processes for reducing vegetables containing starch to a dry powder which is capable of being preserved indefinitely and utilized for preparing mashes and other like dishes without the taste of such mash differing in any way from that of mash prepared with fresh vegetables of the same nature.

In all the hitherto known processes in question, the vegetables such as potatoes are first of all cooked at an appropriate temperature and then reduced to a damp powder which is finally subjected to a suitable drying by heating.

Now, experience has shown that the damp powder obtained in the first phase of the process became sticky during the subsequent heating, particularly when it was applied in a thick layer against the heating surface, and this impaired the quality of the final product, making it useless in particular for preparing mashes.

The improvements which are the object of the present invention enable this drawback to be overcome.

According to the invention, the cooked vegetables are placed in the presence of a suitable quantity of perfectly dry powder, such as is obtained in the last phase of the process. After treating this mixture in a heated drum provided with a stirring device, it is found that the particles of the final product have no tendency to adhere to each other, even although they are placed in a very thick layer.

Another essential feature of the invention consists in the fact that the mixture of cooked vegetables and of dry powder is treated in vacuo. The same treatment in vacuo may moreover be effected in the first phase of the process in which phase the cooked vegetables are reduced to a damp powder.

Hereafter an embodiment of the improved process which is the object of the invention will be described by way of example, as applied to the preparation of potato powder or flour.

In an open or closed drum (for example of 100 litres capacity) provided with a suitable stirring device and heated by means of non-superheated steam, are introduced 40 Kgs. of a mixture of potato powder formed, for example, by 32 Kgs. of cooked potatoes and by 8 Kgs. of dry powder such as is obtained by means of the present process at the end of the treatment. The mixture thus obtained is stirred, for example for 30 minutes, and at the end of the operation 16 Kgs. of perfectly dry potato powder are obtained which is capable of being used for preparing mashes.

As previously stated, the treatment in vacuo may be carried out, according to the invention, in the two phases of the process, that is to say both during the transformation of the cooked vegetables into damp powder and during the transformation of the damp powder into dry powder.

In the example which has just been described, it was assumed that the quantity of dry powder added to the cooked potatoes was 25% by weight. It is, of course, understood, that this proportion is only given by way of example and that it may vary from one case to the other, according to the nature of the vegetables treated.

ZELMANAS VOLPERTAS.

Published July 13, 1943 Serial No. 265,607

ALIEN PROPERTY CUSTODIAN

UTENSILS, APPARATUS, APPARATUS PARTS EXPOSED TO ATTACKING GASES

Gustav Jaeger, Neu-Isenburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 1, 1939

My invention relates to improvements in the construction of utensils, apparatus, apparatus parts and the like which may be affected by corroding gases, such as hydrogen, hydro-carbons, hydrogen sulphide or the like, by using beryllium cementated materials.

Hitherto it was known to construct utensils, apparatus and apparatus parts such as, for instance, pressure tight, vessels, tubes and the like which must resist the attack of gases such as hydrogen, hydro-carbons, hydrogen sulphide and the like, especially at high temperatures as well as high pressure, from materials such as iron or steel, cementated with other metals, such as aluminium and the like. Now it was found that, especially, through the influence of heat to which the apparatus are exposed a more or less rapid diffusion of the cementating metals into the iron or steel occurs. Hereby the surfaces which face the corroding gases will be exhausted more and more of the resistant cementation means which consequently leads to a reduction of the resistance against the gases and gas mixtures, attacking the walls of the apparatus and thereby rendering them prematurely useless.

Thorough investigations have shown that these disadvantages may be removed to a considerable extent by using iron, for instance, ingot steel, low or high alloyed steels, such as chromium nickel steels, cementated with beryllium as construction material. Nevertheless it has been observed that hereby also a diffusion of the beryllium into the basic metal takes place. This diffusion, however, stops at a certain not exceedable limit with the use of beryllium as cementation means. This is probably the reason why the resistance of apparatus and apparatus parts made of beryllium cementated material of construction is so much better in consequence, and, against the attacking gases their durability so much longer than by using construction materials cementated with aluminium and the like.

According to my invention the beryllium cementated materials of construction are inter alia excellently suited for the construction of utensils and apparatus for the high pressure reaction, for instance, the production of methyl alcohol, hydrogenation under pressure of combustibles and similar processes.

The cementation may be carried out in a very simple manner, for instance, in such a way that the surfaces of the basic metal, if desired roughened, may be coated with a layer of beryllium or provided with a beryllium containing coating, for instance, a beryllium containing lacquer. Thereupon the beryllium is heated to cause its diffusion into the base metal. There is also a possibility to deposit the beryllium by way of electroplating on the base metal and then causing it to diffuse by the influence of heat. Instead of beryllium other compounds of beryllium which are suitable to yield metallic beryllium, for instance, reducible beryllium compounds, may also be deposited on the base, whereupon the beryllium is set free, for instance, by reducing means and then caused to diffuse by heating.

Other metals, such, for example, as copper, nickel, tungsten, titanium, vanadium, aluminium, either alone or together, may also be introduced into the base metal besides the beryllium. Hereby the cementation process may be carried out in such a way that the beryllium or compounds which yield metallic beryllium are deposited in admixture with other metals or those yielding compounds on the base and then submitted to joint cementation. According to my invention, one may proceed, for instance, also in such a way that the cementation begins with the admixed metals, whereupon the beryllium finally will be cementated. At all events care is to be taken that the cementation of beryllium is carried out properly with the purpose of obtaining an increased resistance of the construction material.

Moreover, my invention may be carried into effect by submitting the beryllium cementated construction materials first to an advantageously prolonged heating whereby the beryllium is caused to diffuse up to the aforementioned limit and afterwards cementating a second time with beryllium.

The cementation of iron, steel and the like with beryllium may be carried out according to my copending application S. N. 248,647 of 30, 12, 1938.

GUSTAV JAEGER.

Published July 13, 1943

Serial No. 265,721

ALIEN PROPERTY CUSTODIAN

AEROPLANE

Claude Dornier, Friedrichshafen A. B., Germany; vested in the Alien Property Custodian

Application filed April 3, 1939

The present invention relates to a new aeroplane construction.

The fuselage of the aeroplane according to the present invention is divided by suitable transverse walls into a plurality of chambers which are situated behind one another. The forward chamber may be used in known manner for receiving crew and/or passengers. The propelling plant is in the rear part of the fuselage. The compartment or compartments which is or are situated between the front compartment and the power plant may be used for luggage, operating material such as fuel, oil etc. The motor or motors drive a push propeller by means of shaft extensions or transmission shafts. The push propeller is located in the rear of the tail unit.

The center of gravity of the aeroplane according to the present invention is so far towards the rear that under normal flying conditions at least one tenth of the total weight is carried by the tail unit or parts thereof.

In order to protect the pushing propeller when starting or landing against contact with the ground or water the power plant is so positioned that the axis of rotation of the propeller and of the drive shaft and the wing chord form an angle which opens rearward and upward, or means are provided for temporarily lifting or swinging the pushing propeller upward. The last mentioned means may be of such nature that only the propeller with its drive shaft can be displaced and the motor remains in its position or that the whole propelling plant including the motor can be lifted or swung. The present invention can be applied to planes in which the propeller is driven by one or a plurality of motors.

By combining the various features set forth above a new aeroplane type is produced which constitutes an important progress in the art. The advantages of the new construction are as follows:

(*a*) crew and passengers are not disturbed by noise or fumes,

(*b*) completely clear vision,

(*c*) unobstructed shooting range,

(*d*) lowest possible resistance of the propelling plant,

(*e*) no undesired influence of the propeller wind on the tail unit.

Division of the fuselage in such manner that the compartment for the pilot and/or passengers is at the nose end of the fuselage was hitherto only possible with multi-motor aeroplanes the motors of which are positioned on the wings or in a special motor gondola above the fuselage. In one-motor aeroplanes of conventional construction the compartment for the operator and/or passenger may be arranged at the nose end of the fuselage only if the motor is situated above the fuselage. In all these cases the power plant is located outside of the fuselage and causes greater air resistance than a power and driving plant which is located within the fuselage. An exception is made by aeroplanes having no tail. Such aeroplanes, however, are not as stable as aeroplanes according to the present invention. Multimotor aeroplanes are in many cases too expensive; the same is the case with arrangements whereby a motor situated in the fuselage drives one or more propellers by means of bevel gears and transmission shafts. The present invention is applicable to land planes as well as sea planes.

Further and other object of the present invention will be hereinafter set forth in the accompanying specification and shown in the drawings which, by way of illustration, show what I now consider to be a preferred embodiment of my invention.

In the drawings:

Figure 1 is a diagrammatic lateral view of an aeroplane according to the present invention.

Figure 2 is a diagrammatic lateral view with parts broken away of a modified aeroplane according to the present invention.

Figure 3 is a diagrammatic cross-sectional view taken along line **3**—**3** in Fig. 2 of an aeroplane according to the present invention.

Referring more particularly to Fig. 1 of the drawings, numeral **1** designates the fuselage the interior of which is divided by means of walls **2** and **3** into three compartments. The forward or nose compartment **4** serves as room for operator and passengers. The intermediate compartment **5** may serve as storage for operating material, luggage etc. The rear or tail compartment contains a motor **7**, which drives the pushing propeller **9** by means of a shaft **8**. The axis of rotation of the propeller **9** and shaft **8** form with the chord of the wing **15** an angle α which opens rearward and upward. Forward of the propeller and below shaft **8** is the tail plane **10** and elevator **16**. Numeral **11** designates the fin and **12** the rudder.

If an aeroplane of the type shown in Figure 1 is built as an amphibian an undercarriage is provided having wheels **13** which can be laterally swung into suitable recesses of the fuselage into the position **13'** when the machine has taken the air. A forward landing wheel **14** is provided which also can be swung into a suitable recess

of the fuselage into the position indicated by numeral **14'**.

Figure 2 is a lateral view of an aeroplane according to the present invention having a displaceable power plant and propeller. The rear part of a lateral wall of the fuselage is broken away so that the motor and its swingable support is visible. The fuselage is divided into three compartments by means of the partition walls **21** and **22**. The forward or nose compartment **23** may be used for accommodating passengers and pilot.

In the intermediate compartment **24** containers for fuel and oil, luggage and the like may be stored. The rearward part of the fuselage contains a motor **25** which drives the pushing propeller **27** by means of the shaft **26**. In front of and below shaft **26** is the tail plane **28** and the elevator **36**. The motor **25** together with its support **29** is swingable about an axis **30**. A hydraulic cylinder **31** is provided which is swingably connected at **32** with the fuselage. If a pressure fluid is supplied to said cylinder motor **25** is swung upward. The bearings of shaft **26** and the pushing propeller **27** and also the part **33** of the fuselage which is located above the shaft **26** are rigidly connected with the motor and its support. The movable part **33** of the fuselage can also be seen in Fig. 3. Whenever the motor **25** is swung upward the shaft **26**, the propeller **27** and the fuselage part **33** also are swung upward so that they assume the position indicated in dash- and dotted lines and designated by numerals **26'**, **27'** and **33'**. The larger part of the rearward end of the fuselage together with the tail plane and elevator remain in their original position. There are two fins and two rudders which may be connected to the outward end of the tail plane and positioned on both sides of the driving unit. The aeroplane according to Fig. 2 may also be built as an amphibian and is then provided with landing wheels **34** which can be swung into the position designated by numeral **34'** and a forward landing wheel **35** which can be swung into the position **35'**.

While I believe the above described embodiments of my invention to be preferred embodiments, I wish it to be understood that I do not desire to be limited to the exact details of design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

CLAUDE DORNIER.

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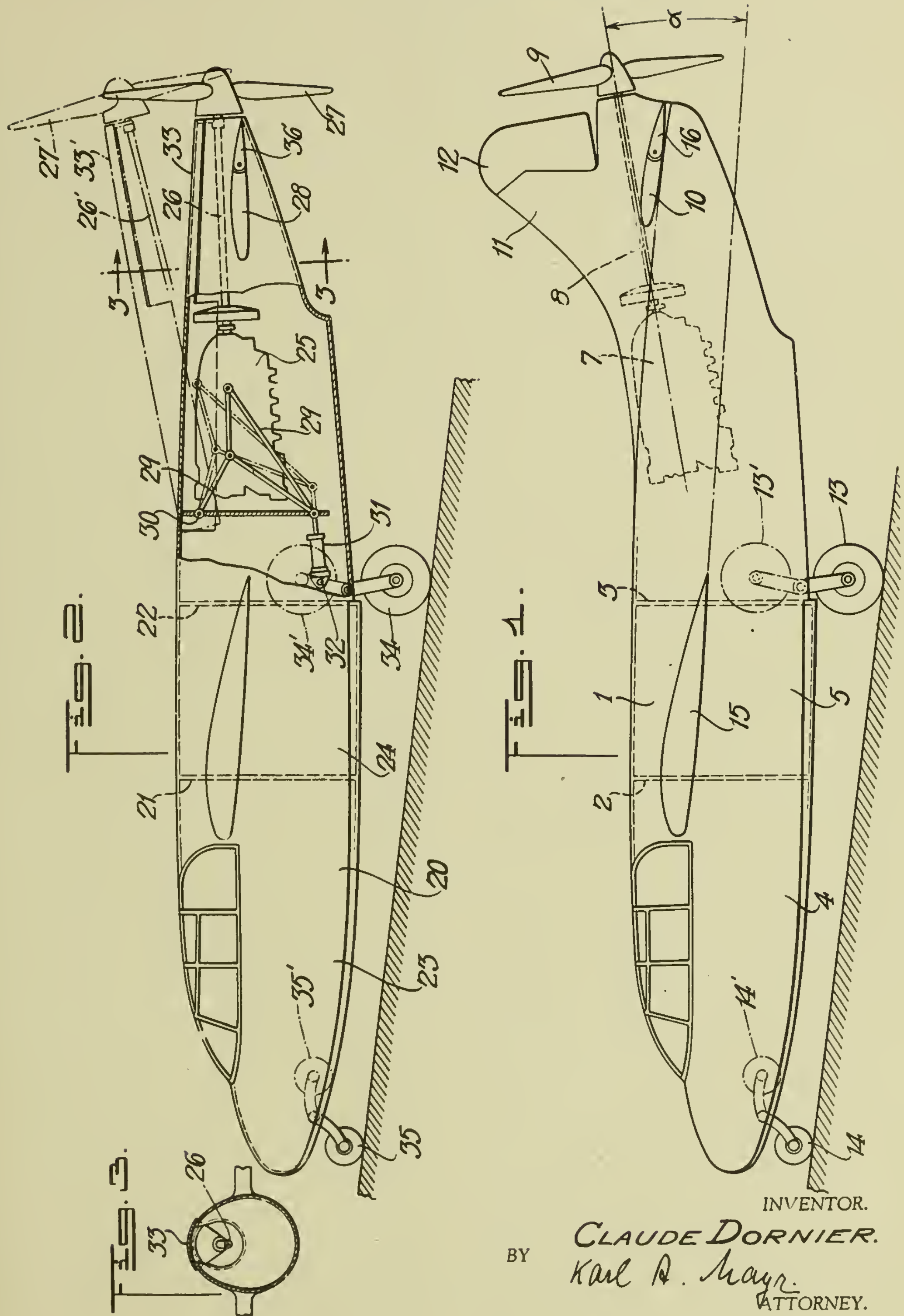

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF CARBON BLACK

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No Drawing. Application filed April 8, 1939

It is well known that carbon black, especially the so-called active rubber black, can be produced by burning carbonaceous materials such as naphthalene or anthracene residues in burners with restricted quantities of air, the carbon black produced being made to deposit on cooled surfaces. By carrying out this process on a large scale, however, contrary to excellent working in a testing plant, undesired variations in the yield, in the color, in the activity, in the content of empyreuma and other qualities were observed. Experiments made to eliminate these disadvantages by keeping constant or regulating the given working conditions were without any result, rather causing economically impossible interruptions of the work.

Now it was found that excellent results may be obtained also on a large scale by carrying out the incomplete combustion of carbonaceous substances in mixture with combustible or incombustible gases in burners in such a way that the burner gases are as far as possible laminarily adjusted. According to my invention it is essential that the area of flow of the burner gases in the whole burner place will be kept substantially free of any whirling motion. This may be obtained at first by laminarily adjusting the hot gases outside the flames, i. e. the mixtures of burnt gases and secondary air, by means of uniform introduction, guiding sheets and the like. Furthermore, dividing walls and subdivisions between the burners tend to restrict eventually occurring whirl like disturbances both in time and in space. It is most important to avoid the noxious whirling formations in the course of the gas flow in the burner place, on the deposition areas and on the way to the gas delivery tube, in such a way that on the whole cross section of the apparatus a substantially uniform suction is maintained. I have now found that already rather small differences in space in the suction effect suffice to create whirl formations and therewith the aforementioned disadvantages. This may be avoided, for instance, in such a way that the whole furnace unit on the upper part is covered rooflike, whereby this covering may be provided out with a plurality of division walls. The passing on of the burner gases on the upper part of this rooflike covering is then carried out by a plurality of hoods which finally are united to a common gas delivery tube.

Variations of pressure and flow beyond these hoods may lead sometimes to a disturbance of the laminar area of flow in the interior of the burner space. In order, to avoid these disturbances draft interruptions may be inserted into each hood so that with a small increase of suction "false air" will be sucked in with and thereby disturbances of the burner space avoided. On the other hand, eventually occurring obstruction by the aforementioned draft interruptions may be rendered innocuous by equalization of pressure in the open air.

Besides the above mentioned steps which refer to the operations outside the flame front it is essential to keep the flame gases as far as possible also laminarily adjusted inside the flame front. According to hydrodynamic fundamental laws this may be carried into effect by an adequate adjustment of the composition of the gas, the gradient of pressure, the space velocity, the space between the burner orifice and the cooled area and so on. Thereby it is important to construct the burners with final parallel conducts in such a way that these parallel conducts exceed the width of the holes. Especially with slit burners it has been proved necessary that the final parallel conduct exceeds the width of the slit like burner orifice. By these steps an excessive divergence at the end of the burner orifice will be avoided and consequently the formation of whirls inside the flame front and to a certain extent also outside thereof will be reduced.

According to my invention these measures tend to a substantially laminar conduct of the burner gases inside of the whole burner space. This may be recognized, for instance, already in a stability of the flame front both in time and in space. Contrary to the common sooting flames the flames according to my invention stand practically absolutely still. Moreover, the laminar conduct effects that the lines of contact of the flames with the cooled areas, i. e. the sledge or the advantageously used water cooled cylinders remain practically unchanged.

The scope of my invention lies in the production of carbon blacks of desired activity, color, content of empyreuma or the like in a substantially uniform condition with maximal yields. With working conditions prescribed it suffices only, according to my invention, to consider the above mentioned measures with the result of an excellent, simple and safe conduct of operation.

By carrying out my invention all sorts of carbonaceous initial substances may be utilized, such as for instance, propane, butane, benzene, naphthalene or other aliphatic or aromatic hydrocarbons or mixtures, as for instance, anthacene residues. Instead of or besides these substances also gaseous substances which are lower in carbon, i. e. richer in hydrogen, such as carbonmonoxide, methane, ethane or the like may be used. In practice town gas generator gas, water gas, eventually in combination with liquid gas may be loaded with heated naphthalene or anthracene residues, the quantity of these higher boiling constituents adjusted preferably in a range of about 250 grs. to about 1000 grs./Ncbm of the total mixture.

HARRY KLOEPFER.

[illegible]

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF OXYGENATED CARBON COMPOUNDS

Otto Roelen, Oberhausen-Holten, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 15, 1939

My invention relates to the production of oxygenated carbon compounds and more particularly to the production of valuable oxo compounds, such as aldehydes and ketones, and hydroxy compounds, such as alcohols.

It is an object of my invention to produce such oxygenated substances from organic compounds which contain olefinic double bonds by acting thereon with carbon monoxide.

Other objects of the invention will appear as the specification proceeds.

I have found that carbon compounds which contain olefinic double bonds can be converted into oxo compounds by an addition of carbonyl groups =C=O. To this end I act with carbon monoxide and, if desired, with hydrogen in the presence of a suitable catalyst on the unsaturated starting carbon compounds preferably under increased pressure of at least 20 atmospheres and at moderately elevated temperatures of for instance 50 to 200° C. Aldehydes and ketones are mainly formed according to the following fundamental equations:

$$(1)\quad R.CH{=}CH.R+CO+H_2=R.CH_2{-}\underset{\displaystyle CHO}{\underset{|}{CH}}.R$$

$$(2)\quad 2R.CH{=}CH.R+CO+H_2=R.CH_2{-}CRH{-}CO{-}CRH{-}CH_2.R$$

wherein the "R" are hydrogen or similar or different organic radicals.

If sufficiently high pressures of at least about 50 atmospheres are employed, the reaction proceeds with practical yields already at temperatures as low as for instance 50–100° C. at which the carbon monoxide is not yet appreciably decomposed by reduction, so that the carbonyl group is maintained in the condensation reaction and mainly oxo compounds, such as aldehydes and ketones, or derivatives of these oxo compounds, which may form under the operating conditions, are produced, while methane is not formed in objectionable quantities.

If lower pressures are employed, the temperature must be chosen the higher, whereby however part of the carbon monoxide is decomposed by reduction under the formation of hydrocarbons and water and/or carbon dioxide. Another part of the carbon monoxide is again caused to condense with the unsaturated organic starting compounds, so that the reaction product consists of hydrocarbons, oxygen derivatives of hydrocarbons and water, if for instance pressures of about 1 to 10 atmospheres and, correspondingly, temperatures of about 180° C. are employed. These oxygen derivatives of hydrocarbons generally comprise oxo compounds and hydroxy compounds in proportions which depend on the catalysts and the operating conditions employed.

I may employ as unsaturated starting carbon compounds in the first line gaseous, liquid or solid olefin hydrocarbons, such as ethylene, propylene or butylene, or the higher and even the highest known homologs of this series. I may further employ cyclo-olefines or unsaturated naphthenes or mixed aliphatic hydrocarbons, i. e. aliphatic hydrocarbons, which contain aromatic radicals, for instance styrol, $C_6H_5.CH{=}CH_2$, or hydrocarbons of the terpene series, such as limonene or pinene, or products of substitution of these unsaturated hydrocarbons, for instance unsaturated alcohols, aldehydes, ketones, acids or halogen derivatives, which by condensation with carbon monoxide are converted, respectively, into keto alcohols or oxy aldehydes or di-ketones or keto-aldehydes or di-aldehydes or di-ketones or aldehydic acids or ketonic acids or halo-aldehydes, -ketones or -acids.

Gases which contain carbon monoxide in addition to other gases can be employed instead of pure carbon monoxide. I prefer to use gases which contain carbon monoxide and hydrogen, such as water gas, but I may also use mixtures which are richer or poorer in carbon monoxide in relation to hydrogen than water gas.

The condensation of carbon monoxide with the unsaturated carbon compounds is preferably carried out in the presence of hydrogenating catalysts. The metals of the eighth group of the periodic system of elements, especially iron, cobalt and nickel, have proven particularly suitable, and their catalytic efficacy can be increased by the addition of activators such as the oxides and hydroxides of alkali metals, chromium, manganese, aluminium, thorium or magnesium. The catalysts may be employed in solid form and for instance in finely divided state arranged on carriers, such as kieselguhr, and the compounds to be reacted are in this case passed over the catalysts in form of gases or vapors. It is however also possible to apply the catalysts in liquid phase and to suspend the catalyst for instance in an inert liquor, such as saturated paraffin or benzene, or in the liquid unsaturated carbon compounds to be reacted and to contact under increased pressure the gas or gas mixture, which contains the carbon monoxide, with this suspension of the catalyst.

For each catalyst there exists a certain limit of temperature such that under a predetermined pressure mainly or exclusively oxo compounds

are formed below said critical temperature, while under the same pressure the formation of alcohols starts becoming remarkable at said temperature limit and increases with increasing temperature. The temperature limit depends also on the excess of hydrogen present and on the time of reaction, and on the nature of the specific unsaturated compound treated.

The temperature limit lies in the range of 100–140° C. for a catalyst comprising finely divided cobalt. Mainly or exclusively oxo compounds are produced with this catalyst from ethylene, propylene or the higher homologs which boil for instance between 40 and 200° C. or the still higher boiling olefinic hydrocarbons contained in Diesel oil or from similar compounds, if temperatures below 100–120° C. are used, while above 120–140° C. the corresponding alcohols are formed in increasing quantities.

The yield of oxygenated carbon compounds is relatively low under low pressures, and increases with higher pressures at the same temperature. The reaction participants are converted in larger quantities even under low pressure, if the temperature is raised. Higher temperatures cause however that the hydrogenated products of the olefines and of the oxo compounds and finally of the carbon monoxide are simultaneously formed in increasing quantities. Saturated hydrocarbons are thus formed from the olefines, alcohols from the oxo compounds and, at still higher temperatures, hydrocarbons from carbon monoxide. The temperature is therefore chosen in dependency on the products which shall be produced or are desired in each particular case. Temperatures are avoided which are so high that the desired products are already decomposed or that the olefinic starting materials or even the carbon monoxide are decomposed under the formation of carbon or hydrocarbons and are thus prevented from reacting with each other according to the reactions mentioned above. If particularly active catalysts are used, one obtains good yields of oxo and/or hydroxy compounds, even if relatively low pressures and relatively low temperatures are employed. As a rule I do not operate below about 40° C., and at such low temperatures I employ pressures of more than 100 and even 300 atmospheres in the case that the reaction gases or vapors are passed over the catalysts. If the reactants are however enclosed in an autoclave, pressures of about 20 atmospheres may suffice even if the low temperatures mentioned above are used, since copious quantities of the oxygenated compounds are formed after the lapse of for instance 10–20 hours. If the gas to be reacted is passed over particularly efficient catalysts, moderately increased pressures of about 40 atmospheres are sufficient with the use of a temperature of about 40° C., while the yield may be considerably increased by correspondingly higher pressures.

The yield will be the higher, as a rule, the longer the time of reaction, i. e. the time during which the reactants are contacted under the operating conditions with the catalysts. If the reactants are maintained in contact with the catalysts during a time which is very extended with regard to the temperature and pressure employed, secondary reactions may occur, and the aldehydes primarily formed can for instance be caused to condense.

I have found it advantageous under certain conditions to quickly withdraw the primary products of reaction, if the reactants are passed in form of gases or vapors over the catalyst. In this manner I am enabled to increase the time of reaction, i. e. the time during which the reactants are contacted with the catalysts, while the primary products are not exposed to the catalysts and the high temperature and pressure conditions during so long a time that they could be converted into undesired substances. I succeed therein by recycling the reaction gas and by withdrawing the primary products of reaction each time before the gas is once more contacted with the catalysts.

In view of the very different compounds which may be used as starting materials for the conversion into oxygenated carbon compounds, and in view of the wide ranges of temperatures and pressures which may be employed with these different compounds and with the different catalysts to be employed, the time of reaction may vary within wide limits and for instance between a few seconds and several hours. Everybody skilled in the art will however be enabled to choose the correct and optimal conditions for each starting material employed, if reasonably applying the principles fully disclosed in this specification.

I may thus for instance produce propylic aldehyde and normal propyl alcohol from ethylene; normal and iso butylic aldehyde and normal and iso butylic alcohol from propylene; 2 methyl valeric aldehyde, 2 ethyl butyric aldehyde, 2 methyl valeric alcohol and 2 ethyl butyric alcohol from 2-pentene $H_3C—CH=CH—CH_2—CH_3$. I may further react carbon monoxide and hydrogen, in the presence of hydrogenating catalysts, with substances such as allyl-alcohol, geraniol, acrylic aldehyde, crotonic alcohol and crotonic aldehyde, methyl heptenone

$$(CH_3)_2C=CH—CH_2—CH_2—COCH_3$$

mesityl oxide $(CH_3)_2C=CH—COCH_3$, phorone $CH_3—C=CH—CO—CH=C(CH_3)_2$, ionone, styrol, cinnamic aldehyde and cinnamic alcohol, stilben $C_6H_5.CH=CH.C_6H_5$ or eugenol.

The oxygenated components produced according to my invention are highly valuable. The oxo compounds serve mainly for further conversions and for instance for the production of fatty acids. The alcohols are suitable as wetting agents or as solvents for instance for lacquers.

Example 1.—Through a reaction tube filled with a cobalt-thorium catalyst, which is composed of 100 parts cobalt, 15 parts thorium and 200 parts kieselguhr and of which 400 to 500 grams are arranged in one liter, there is passed at a temperature of 90–100° C and under a pressure of 100 atmospheres a mixture containing ethylene, carbon monoxide and hydrogen in a ratio ranging between 1:1:1 and 2:1:1 The heat of reaction formed is allowed to escape, so that the operating temperature is maintained with an accuracy of about 1–2° C. To this end the reaction tube may be arranged for instance in a water bath or oil bath. If 100 normal liters of the gas mixture, i. e. the quantity which at room temperature and atmospheric pressure occupies 100 liters, are passed hourly through one liter of the catalyst space, 300–400 grams liquid products are obtained from 1000 normal liters of the starting gas mixture. No gaseous secondary products are formed in noticeable quantities. Since therefore only inert gases, such as nitrogen, if present, are enriched in the final gas, this final gas can be used for another condensation reaction, if desired after the concentration and

the relative proportions of the three reaction participants have been corrected. The gas may also be led through the reaction room and devices for separating the oxygenated compounds in continuous cycle, and the yield can still be increased in this manner, for instance up to 700 grams of liquid products per 1000 normal liters. The liquid products obtained can be separated by a simple fractionating operation into about

	Percent
Propionic aldehyde	40
Diethyl ketone	20
Higher boiling aldehydes and ketones or other oxygenated compounds	40

Example 2.—A reduced cobalt thorium kieselguhr catalyst is suspended in an oil of turpentine, 90% by volume of which boil below 170° C, in the proportion of 10–20 grams of the catalyst per liter of the oil. This suspension is exposed to water gas, which contains 50% by volume H_2, 45% CO and 5% N_2+CO_2, under a pressure of up to about 200 atmospheres above normal. The mixture is thoroughly stirred at temperatures of 120–140° C during three hours. The oil of turpentine absorbs during this treatment 135 normal liters carbon monoxide and about the same amount of hydrogen per kilogram oil, while the specific weight rises from 0.863 to 0.942. The product of reaction contains 7.3% oxygen and shows all reaction characteristic of aldehydes, and can for instance simply be reacted with sodium bisulfite. The reaction product appears to contain an aldehyde deriving from pinene.

Example 3.—In the manner described in Example 2 I can also treat, instead of the oil of turpentine, a synthetic lubricating oil obtained by a condensation of olefines under the action of aluminium chloride and having an iodine value of 87 and a specific weight of 0.852. 1 kg of this lubricating oil, if exposed during about 3 hours to a temperature of 120° C and a pressure of 125 atmospheres, absorbs 20 normal liters CO and approximately the same quantity of H_2. The specific weight increases up to 0.860 and the viscous mass contains aldehydic compounds, which according to my experiments can be reduced by hydrogen to highly viscous alcohols.

The oxo compounds obtained for instance according to Examples 1–3 can subsequently be reduced to the corresponding alcohols. This reduction may be carried out in the same reaction vessel and with the same catalysts, for instance by a change of the temperature or of the hydrogen concentration or of the pressure. The reduction may, however, also be carried out with some other reducing catalysts and in different reaction vessels.

According to my invention primary and secondary alcohols can however also be obtained directly from the unsaturated carbon compounds mentioned above under the action of carbon monoxide, as illustrated in the following example.

Example 4.—A mixture of ethylene, carbon monoxide and hydrogen in a proportion ranging between 1:1:1 and 1:1:2 is passed under a pressure of 100 atmospheres and at a temperature of 200° C with a flowing velocity of hourly 100 normal liters of the gas mixture through one liter of a catalytic chamber which is filled wtih 800–1000 grams per liter of a cobalt catalyst produced by impregnating pumice stone of a mean particle diameter of 1 to 3 mms. with the nitrates of cobalt, copper and thorium in the proportion of approximately 100 parts CO, 3 parts Cu and 18 parts ThO_2 and subsequently roasting and reducing these nitrates. 250 grams liquid products are obtained per 1000 normal liters of the gas mixture passed through the catalytic chamber and 70% of these liquid products consist of normal propyl alcohol.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

OTTO ROELEN.

[illegible]

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREPARATION OF ACTIVE SO-CALLED GAS-BLACK

Hans Backe, Dortmund, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 15, 1939

My invention relates to a process for the preparation of active so-called gas-black especially used for the reinforcement of rubber in the rubber tire industry and the like and is more particularly concerned with the preparation of active gas-black by incomplete combustion of hydrocarbons.

Now it has been found that by an incomplete combustion of hydrocarbons, particularly those with increased vapor tension, in a mixture with combustible or incombustible gases, the carbon black produced in the flames being deposited on cooled surfaces, for instance, discs, rings, rolls and so on, a considerable part of the produced gas-black of these gaseous mixtures which contain about 350 grs/cm and more of combustible hydrocarbon will not be deposited on the cooled surfaces but carried off with the hot waste gases. This gas-black carried away by the waste gases is of such a fine condition that it is extraordinarily difficult to precipitate the product from the gases. This leads to the provision of very expensive devices in the apparatus for the recovery of the aforementioned gas-black. In spite of such devices as, for instance, filter or the like, a considerable amount of the gas-black will not be deposited. These quantities will be carried off with the waste gases so that the yield of active gas-black decreases heavily. Furthermore, the gas-black which is carried off with the escaping waste gases will, contrary to the gas-black which is being made to deposit on cooled areas, not be cooled down quickly so that in consequence thereof its qualities differ in many respects from the gas-black deposited and cooled on the deposition areas. The qualities of the product depend, of course, on the ratio of the quantities between the deposited gas-black and that carried away with the waste gases as it is not possible to separate quantitatively the gas-black deposited on the cooled surfaces and the gas-black which was carried away and afterwards recollected.

The object of my invention is the nearly total deposition of active gas-black made from gaseous mixtures with a high content of hydrocarbons on cold or cooled deposition areas. Now it was found that a considerably better yield of gas-black may be obtained even from incompletely burnt gaseous mixtures with high contents of hydrocarbons if care is taken to decrease the concentration of the gas-black in the flame towards the deposition area in such a way that a collision between the glowing particles of the gas-black is avoided. According to my invention this may be carried out in such a way that for the step of combustion of the gaseous mixtures highly loaded with hydrocarbons burners will be employed which possess a short and narrow slit and are equipped in such a way that the flame burns fan-like. It has been proved advantageous to perform a burner with a curved slit of a relatively short length as outlet. With a length of, for instance, 10 to 15 mm. and the shortest distance between the roll and the burner, a length of the flames of about 100 mm. is obtained.

By carrying out my invention and with the use of burners with narrow, short and concave, curved slits the flame will always burn steadily even with the highest loads. The burners remain clean. A reflection of gas-black particles from the roll and whirling away with the waste gases only takes place in the least negligeable grade. The yield of the gas-black deposited on the roll increases considerably in such a way that often 20 to 30 percent more of the deposited gas-black may be produced than before. In consequence to the fact that practically all gas-black is deposited on the cooled surface the gas-black is uniform in its qualities. A further consequence of my invention is an almost complete reduction of the contamination of the air, owing to the fact that a whirling and carrying away of the gas-black in the waste gases over the roof is practically avoided.

HANS BACKE.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREPARATION OF HOMOGENEOUS MIXED PRODUCTS

Erich Kaufmann, Oberursel, Germany; vested in the Alien Property Custodian

Application filed April 17, 1939

The object of my invention is a process for the preparation from at least two different substances particularly from metals, of homogeneous mixed products, which with regard to their properties may be classified between true alloys and pure additive mixtures of the particles, such as are for example to be found in metalloceramic sintered substances. The process of this invention is particularly suitable for the preparation of mixed products from metals, which cannot, or can only with difficulty, be combined to form alloys.

As examples of mixed products which can be prepared according to this invention, mention may for example be made of silver+nickel, iron+lead, copper+iron, etc. The mixtures may be prepared in any desired proportions, as for example, 60% of silver+40% of nickel, 85% of iron+15% of lead, etc.

The process of my invention is also particularly suitable for the preparation of homogeneous mixed products from metals, which possess very different specific gravities, as for example aluminium and lead. In this case also products of any desired proportions may be prepared, for example products which contain 80% of aluminium and 20% of lead.

My invention enables products to be prepared which possess for example the properties of alloys of the components and also the properties of the components themselves. It is consequently possible, depending on the working conditions, for example, the nature of the components, proportions, more or less fine division of the particles, to cause one or other property to be more strongly manifested and another to be more or less repressed.

Mixed products, consisting for example of iron and lead, may be used for the preparation of oilless bearings. In such a case the iron functions to support the shaft, whilst the lead effects lubrication. In this case particularly favourable effects may be obtained if the two non-alloyable constituents, iron and lead, are disposed side by side in a state of very fine division.

Mixed products of for example silver and nickel may with advantage be employed for the production of electrical contact parts. In this case the silver mainly acts as conductor, whilst the nickel prevents the contacts from sticking.

The process of my invention may for example be carried into effect by subjecting the metals to be combined together, in a molten condition to such intensive mixing, that the constituents are present in an uniform distribution as possible in the mixture, and subjecting the mixture, before separation into its component parts has taken place, to a comminuting operation under rapid cooling.

Known processes and apparatus may be used for mixing the molten components. The mixing operation may for example be carried out in stirring apparatus with rapidly rotating stirrers, or intimate and thorough mixing may be effected by employing gases as stirring means, if desired several such procedures may be used in combination.

In order to comminute the melts or to convert the same into solid products containing the particles in intimate association with one another, known or customary apparatus may be employed. The melts may for example be sprayed or atomised with the aid of nozzles, impact devices or the like, by blowing a current of gas into a jet of melt and the like means. The comminuting process may also be promoted by special procedures, for example by centrifuging the comminuted melt against reflecting surfaces or baffle plates, whereby the melt is still further comminuted. Similarly suitable procedures, such as air-cooling, water-cooling or the like may be employed as auxiliary means and thereby the comminuting and setting process be promoted.

A particularly advantageous method of carrying out the process of my invention is to effect the comminution of the melt by causing the same to impinge on rapidly rotating elements, preferably discs, and at the same time effecting rapid cooling of the particles formed. Cooling liquid may for example be caused to impinge on the rotating disc simultaneously with the molten material, for example by spraying, and be atomised together with the metallic melt. The rotating disc is cooled thereby and owing to the sometimes explosive evaporation of the cooling liquid, the comminution of the metallic melt is promoted and at the same time an advantageously acting vapour atmosphere is produced in the comminuting space or chamber. If necessary, the walls of the atomising space may also be cooled and/or the sprayed material be intercepted in liquids.

The procedure may for example be followed of causing the intimate mixture of molten components to flow continuously out of the mixing vessel, for example, a satisfactorily operating stirrer, in the form of a jet or plurality of jets on to a rapidly rotating disc mounted in a closeable container and promoting the comminuting and solidifying process by suitable cooling procedures, for example by continuously spraying cooling water, for example with the aid of nozzles, on to the disc. The melt impinging on the disc is torn by the action of centrifugal force into fine or extremely fine particles. Depending on the speed of rotation of the disc, the thickness of the jet of melt, speed of feed (height of fall), viscosity of the melt, etc., the process may be extensively controlled, for example with regard to the degree of fineness of the product.

By spraying cooling water on to the disc, the

comminution of the melt is promoted; the disc is cooled and owing to the spraying and atomisation of the cooling agent a vapour atmosphere is produced, by which the particles traversing the same are cooled and are prevented from depositing on the walls of the container. In certain cases the action may be still further improved by special procedures such as irrigating or spraying the atomising chamber with cooling water, irrigating the walls and the like. The lower part of the container may be constructed as a water tank, in which the particles are intercepted and also quenched. It is also possible by passing a cooling gas current or gas currents through the atomising zone to effect as rapid cooling of the particles as possible and on occasion to prevent too rapid contact of the particles with any solid surfaces, for example the container walls. The gas current may in this case also simultaneously serve for cooling parts of the apparatus, particularly the rotating disc. An advantageous procedure is to introduce the gas stream in the neighbourhood, if desired the immediate neighbourhood, of the rotating disc or the point of impact of the melt, with the disc or by blowing cooling gas into the melt at the moment when the latter contacts with the disc or immediately beforehand to promote the comminuting action of the rotating disc. Known apparatus such as injectors, atomisers or the like may be employed for introducing the gases into the atomising chamber or for mixing or blowing gas into the melt.

The rotating disc may of course also be protected by known means against the action of the hot melt, for example by constructing it hollow and by introducing cooling water through a hollow shaft into the interior of the disc.

Particularly good effects are obtained by effecting the cooling and quenching by the combined use of cooling liquid and cooling gas, for example, by blowing cooling liquid on to the rotating disc and also introducing cooling gas into the comminuting chamber.

According to one embodiment of this invention gas is conveyed in such a way and at such speed through the atomising zone, that not only is a cooling action exerted, but at the same time the finely divided material centrifuged off from the disc is further conveyed through a gas stream. In this way it is possible to control the time intervening between the conversion of the melt into a finely divided condition and the collection of the finely divided material in a desired manner and for example to prevent too rapid contact of the particles with the walls or too rapid deposition thereof. An alternative procedure is for example to convey the particles formed or portions thereof with the aid of the gas stream into deposition or collecting chambers connected with the atmoising chamber. In this way it is possible to obtain the particles in individual fractions after the manner of wind-sifting.

The nature of the gas to be employed depends upon the nature and susceptibility of the melts to be worked up. Nitrogen, hydrogen, carbon dioxide, producer gas, illuminating gas and the like may for example be employed.

When working up metals, which tend to react with water, inert liquids or liquids having a reducing action, such as benzene, alcohols and the like, may be employed.

Instead of metals, other substances, which are normally non-miscible or only miscible with difficulty, may be combined together and converted into homogeneous products, containing the constituents in very uniform distribution. Metals and metal compounds, for example metal oxides, or metals and non-metals, for example graphite and the like, may, for example, be converted into homogeneous mixed products. The preparation of products from silver and graphite may be mentioned by way of example. Such products may for example be advantageously employed as electrical contact parts, the desired hardness being obtained by the graphite constituents, whilst the silver acts as a conductor.

In the preparation of the mixed products all the constituents of the initial mixture may be molten. An alternative procedure however is to employ one component or a plurality of components in a molten condition and to distribute another component or other components in for example a fine powdery condition or fine powdery form as uniformly as possible in the melt by stirring or the like procedures and to convert the mixture, whilst avoiding separation into its component parts, in accordance with the invention into smaller solid products which contain the components in a condition of uniform distribution.

In certain cases the procedure may be followed of first producing the mixture of the components in the atomising apparatus, for example by introducing the components in a molten condition in separate jets into the atomising apparatus, for example in such a way that the individual jets meet on the rotating disc or immediately beforehand. Furthermore, into a melt, which contains one component or a plurality of components, the other, for example a powdery, component may be introduced by blowing in or the like procedures.

The invention offers many possibilities for the uniform and intimate combination of substances, which hitherto could not be combined or could only be with difficulty combined to form homogeneous products. Particular advantages are to be found inter alia in the fact that the process may be regulated as desired in various directions, for example with regard to proportions, degree of comminution, degree of fineness, etc., and consequently the desired properties be imparted to the products, in order to adapt them in the best possible manner to any further intended treatments. Particles may for example be produced, which pass through a 10,000 mesh sieve or still finer particles or coarser particles.

The particles may for example also be influenced with regard to their density or porosity.

The multi-substance products prepared according to this invention may be employed for different purposes. They are inter alia admirably adapted for the construction of products and articles by metalloceramic methods. For example, it is possible by cold or hot compression of the products consisting of two or more components, if desired with the admixture of additional substances, to produce articles of the desired shape. The products may be worked up as such or if desired after intermediate treatments, such as comminution, sieving, etc.

ERICH KAUFMANN.

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ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF DENTURES

Valentin Weickel, Francfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 21, 1939

The use of artificial resins for the manufacture of dentures such as artificial teeth, tooth crowns, bridges, plates and the like is a well known fact.

Now it has been found that the character of artificial teeth and the like made from artificial resins may be improved considerably as regards resistance against fracture and impact by adding fibrous material to the artificial resin. The fibrous material may originate from organic or inorganic substances, inter alia from cellulose, artificial wool, asbestos, mineral wool, glass wool and the like. It has been proved advantageous to use fibrous material of different kinds together for instance, inorganic and organic fibrous material in admixture. Some fibrous materials, such as asbestos, may be utilized in the form of wool as well as in the form of thin (fine) fibres.

As artificial resins may be used condensation products, for instance, compounds of phenol formaldehyde, condensation products from polyvalent alcohols, such as glycerol, pentaerythrite with polybasic acids, as for instance, adipinic acid, phthalic acid, maleinic acid, citric acid, tartaric acid and the like. Excellent results were obtained with artificial resins, originated from polymerisation, such as polyvinylchloride, polyvinylacetate, polystyrol, especially polymerisates of compounds, particularly acids of the type of acrylic acid and metacrylic acid. Mixtures of several artificial resins, for instance, mixtures of various polymerisates, mixed polymerisates and so on may be used with advantage. The artificial resins may contain usual additions, such as softenings, filling materials, pigments, colors and the like.

The manufacture of artificial teeth and the like may be carried into effect, for instance, in such a way that the artificial resins, for example polymethacrylic methyl ester, polymethacrylic acid ethyl ester or their mixtures, or mixtures of polymethacrylic acid esters with polyacrylic acid esters, are mixed with the fibrous material, for instance, purified and dried powder of asbestos, the resulting mixture afterwards worked up to artificial teeth and the like. Thereby the artificial resin may be transferred (converted) into a liquid or pulpy condition with the aid of solvents or by heating or by both means, in order to be mixed easily with the fibrous material and worked up subsequently. The artificial resin may also be mixed in a pulverulent condition with the fibrous material, the resulting mixture then formed with the aid of heat and pressure. Furthermore, my invention may be carried out in such a way, that the artificial materials are produced in the presence of the fibrous material, i. e. that the polymerisation or condensation is performed wholly or partly in the presence of the fibrous material. For instance, the still liquid pre-polymerised material or mixtures of, for example, pre-polymerised and finally (finished) polymerised material, may be mixed intimately with the fibrous material, whereupon the finishing polymerisation takes place. So, for instance, vinyl chloride or monomeric methacrylic acid methyl ester and ethyl ester or pre-polymerised products of these compounds may be mixed with pulverulent asbestos and the resulting mixture after shaping allowed to polymerise finally.

The proportions between artificial resin and fibrous material may be varied considerably, according to the origin and character of the artificial resin or mixtures of the artificial resins, to the kind of the fibrous material and the desired properties of the finished products.

The incorporation of fibrous material into the artificial resins offers a further special advantage by incorporating (admixing) into the mixtures more hardening substances, such as, for instance, finely powdered precious stones or half-precious stones, quartz, aluminium oxide, especially in highly sintered form or the like. The incorporation of the aforementioned substances produces a special hardness without giving result to an undesired increase in susceptibility against fracture and the like.

The artificial resins may be utilized in a clear translucent form or may be colored, if desired, with soluble dyestuffs to a more or less translucent color (transparent color). Finally, pigments such as zinc sulfide, barium sulfate or the like, may also be added.

The dentures, for instance, artificial teeth, may be manufactured also out of several layers with different translucidity, for instance, in such a way that the separate layers are made from mixtures of the artificial resin or of artificial resins with different contents of fibrous material, or from mixtures with hardening and/or pigmenting solid substances. The composition of the various layers may be varied gradually, the upper layers containing only few solid substances, the uppermost layer absolutely free of such admixtures.

VALENTIN WEICKEL

[illegible]

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF CONDENSATION PRODUCTS

Hans Walter, Frankfurt-on-Main, and Hermann Schulz, Neu Isenburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 10, 1939

The invention relates to a process of producing low molecular condensation products, using formaldehyde as a reacting component. It is an object of the invention to produce particularly those organic compounds which contain 3 carbon atoms in the molecule, such as hydacrylaldehyde, acrolein, acrylic acid, propylene glycol, glycerine, allyl alcoho, propionic adehyde, propanol etc.

According to the invention, formaldehyde is reacted with aliphatic aldehydes such as acetaldehyde in the presence of condensing agents and in a medium which does not contain any or only small quantities of water. Instead of aliphatic aldehydes, alcohols or esters may be reacted with formaldehyde in the same way, also derivatives of these compounds may be used, such as paraldehyde, ethyl alcohol, methyl alcohol, or mixtures of same, ethers, dimethyl ether, diethyl ether, acetals, dimethylformal, diethylformal, dimethylacetal. Also inorganic or organic esters of aliphatic alcohols are well suited such as methyl formate, ethyl formate, methyl acetate, halogen compounds as chlorethyl, ethyl bromide, betachlorethyl alcohol. The compounds may be used in the form of their mixtures with each other.

The condensing agent which is used according to the invention is preferably an alkaline substance, such as potassium hydroxide, calcium hydroxide, borax, sodium amide, sodium phosphate, sodium acetate, sodium ethylate, metallic sodium, when alcohols are present, magnesium oxide, calcium oxide.

We prefer to apply such quantities and such an alkalinity of the condensing agent as to cause the least possible quantities of undesirable by products such as resinous substances, e. g. trisodium phosphate is well used for condensing formaldehyde with acetaldehyde according to the invention. When reacting mixtures which contain acetals instead of acetaldehyde, it is preferable to do that in the presence of substances which are more alkaline, such as potassium hydroxide. In such cases it may be useful to apply acidic condensation agents such as aluminum chloride, phosphoric acid, sulfuric acid, beryllium chloride, or the anhydrides of these acids.

As mentioned above, when carrying through the condensation in the liquid phase, it is essential that the reaction mixture contain no water or only small quantities, that is less than 10%, of water. Care is to be taken that the formaldehyde which is to be reacted is as free from water as possible. Thus we prefer to digest usual paraformaldehyde with methyl or ethyl alcohol and after filtering from the undissolved particles to join it with the other compounds of the reaction. Instead of methyl or ethyl alcohol, there are also other solvents which may be used as reaction media, such as higher boiling alcohols, esters, ketones, phenol ethers etc. By using such higher boiling solvents or diluent agents the formation of undesired polymerisation products of acrolein may be efficiently avoided. We prefer to use as solvents especially butanol, glycerine, butylacetate, glycerine triacetate, glycol diacetate etc. The paraformaldehyde may be used in its known slightly soluble form. In order to dry the solution of paraformaldehyde in the solvents such as alcohol, the solutions to be used may be previously mixed with esters or hydrocarbons and subsequently subjected to a distillation whereby the water is removed in the form of an azeotropic mixture. Of course, the water may be eliminated also by chemical agents as for example, by means of metallic sodium. We also use successfully solutions which are obtained by introducing gaseous formaldehyde into water-free solvents or diluent agents as above mentioned. It is also possible to introduce the gaseous formaldehyde immediaetly into the reaction mixture.

When carrying through the invention, we use a mixture which contains, e. g. equimolecular quantities of the reaction compounds and only small quantities of water. When adding to this mixture, while stirring, several percents of trisodium phosphate, the temperature of the mixture rises instantaneously to 50–60° C. In order to regulate the course of the reaction, we prefer to add the acetaldehyde, and eventually also the catalyst, portion by portion. The mixture is well stirred for several hours and heaed when necessary. Thereafter the mixture is subjected to a fractionating distillation. When starting from acetaldehyde and formaldehyde large quantities of acrolein are obtained, whereas by-products such as crotonaldehyde are formed in small quantities only. It is possible to vary the proportions of the reaction components such as of formaldehyde and acetaldehyde. However, it is useful to avoid a large excess of formaldehyde so that the formation of higher molecular products like pentaerythrite may not be favoured. In most cases it is not necessary to isolate the reaction products such as acrolein when they are to be transformed into other valuable substances; e. g. the reaction product, which is formed in the medium containing formaldehyde and acetaldehyde, is advantageously treated by oxidizing agents, whereby acrylic acid is pro-

duced. The reaction mixture obtained after the reaction has been completed may also be treated in such a way as to form glycerine from acrolein, that is, by a directly hydrating process or by adding halogen, hydrolizing and finally reducing the glycerine aldehyde obtained by the previous steps.

In most cases it is only necesary to heat weakly the reaction mixture, as the temperatures of the reaction are in most cases relatively low, that is, below the boiling point of the liquid reaction mixture. If the temperatures necessary for the reaction are high, we prefer to carry through the reaction in the presence of one of the above mentioned high boiling solvents, such as phenol ether.

Higher pressure, especially much higher than atmospheric pressure, may be applied. We prefer to use the elevated pressure when acetals instead of the trialdehydes are to be reacted. Besides that, it is useful to apply higher temperatures or higher pressures or both if formaldehyde or its acetals are reacted with methyl or ethyl alcohol or their esters in the liquid phase, e. g. we heat a solution of formaldehyde or paraformaldehyde or formals in methyl or ethyl alcohol, which solution contains no water or only small quantities of water, in the presence of condensing agents such as calcium hydroxide, barium hydroxide or sodium methylate, at a pressure of several atmospheres. Higher boiling solvents or diluents may be present. Advantageously we add to the reaction mixture also dehydrogenating catalysts such as copper, nickel, iron, etc.

The reaction is generally not stopped until the quantity of the unsaturated compounds, which absorb bromine, is found to have reached an optimum point. In order to avoid the formation of undesirable by products, we often prefer to stop the reaction before this point, which measure may be favourably influenced by rapidly cooling and neutralizing the catalyst.

As we have further found, it is possible to react formaldehyde with alcohols, aldehydes, ketones, esters or ethers in the vapor state, whereby low molecular condensation products are formed, e. g. formaldehyde and acetaldehyde react in yielding hydracrylaldehyde, which is easily transformed into acrolein. The same result is obtained when passing formaldehyde with paraldehyde or with aldehyde or acetals of the acetaldehyde or the isomers of the acetaldehyde such as ethylene oxide at elevated temperatures over catalysts. Instead of acetaldehyde, also the homologues, as propionaldehyde, butyraldehyde, etc., may be used. The ketones react in the same way as the aldehydes, first forming the corresponding methylol compounds. Instead of formaldehyde the acetals such as dimethylformal may enter the reaction, according to the invention. When carrying through the reaction in the vapor phase, water may be present, so that ordinary aqueous commercial formaldehyde may be used as a starting material. In certain cases, especially in order to avoid the Cannizzaro reaction we prefer to use a reaction medium containing no water or only small quantities of water. In this way paraformaldehyde or slightly soluble paraformaldehyde may be dissolved in acetaldehyde or paraldehyde or even in methyl alcohol or ethyl alcohol, and these mixtures may be vaporized and then reacted at higher temperatures, according to the invention. It is not necessary that the reaction mixture be completely homogenous, e. g. paraformaldehyde may be immediately vaporized in mixture with the other reaction components and then treated in the manner described above. The reaction which takes place in the vapor state is not dependent upon the presence of a catalyst, but by means of catalysts higher yields are obtained. Generally also catalysts are to be used which have a condensing or a dehydrating effect, such as alkaline substances like magnesium oxide, alumina, zinc oxide, calcium oxide, beryllium oxide, sodium carbonate, and alkaline phosphates, or also acidic condensing agents like silica gel, aluminum phosphate, boron phosphate, and phosphoric acid on carriers like activated carbon, or even gaseous catalysts, such as phosphorus oxychloride, titanium dioxide, tungstic acid, molybdic acid, etc. Also mixtures or other compounds of these catalysts may be used. We prefer to combine with these catalysts also those substances which have a dehydrating action, such as copper, nickel, iron or their oxides, etc. Also inert gases or gaseous diluents such as carbon dioxide, nitrogen, etc., may be present during the reaction. Thus the acrolein formed by the reaction is prevented from being destroyed. We obtain the same effect when passing the reaction mixture over catalysts with relatively high velocity, which is very useful if very strong conditions such as highly active catalysts, high temperatures, or elevated pressure are applied.

Advantageausly the reaction takes place under decreased pressure, that is, in vacuo, because in this way the formation of by products is prevented. When carrying through the process in vacuo, even the hydroxyl containing methylol compounds which are the primary products of the reaction may be isolated.

We have found that polymerisation processes are inhibited if the reaction mixtures are cooled, immediately after they have left the reaction chamber. It is also desirable to add inert diluent agents to the reaction mixture before or after the reaction. These diluent agents may be higher molecular hydrocarbons and, in several cases, water too. The temperature of the reaction may vary within wide limits. At any event, the temperature must be sufficiently high so as to prevent the components from condensing on the catalyst, but not so high as to cause undesirable decomposition. We prefer to use temperatures between 150–400°.

The present invention is shown by the following example:

Example

An aqueous solution of about 30% formaldehyde is vaporized, together with about the equimolecular quantity of acetaldehyde. The vaporous mixture is passed over alumina at temperatures between about 260° and about 300° C. In the reaction mixture acrolein is obtained in a yield of about 50% of the theoretical yield. By the measures mentioned above, the yield of acrolein may be increased.

According to the conditions of the reaction, the reaction product contains hydracrylaldehyde, dimethylol-acetaldehyde, glycerine, glycol, proxylene glycol, acetol, butanol, or unsaturated compounds, such as acrolein, vinyl acetol and the like. The products may be isolated from the reaction mixture by fractional distillation or by extraction. It is also possible to treat the reaction mixture without isolating the different products, in order to transform these products into other valuable substances, e. g. a reaction product which contains principally acrolein may be subjected to

an oxidizing process whereby crotonic acid or crotonic esters are obtained. The reaction mixture may also be treated to form glycerine directly.

Although the invention has been described in connection with a preferred embodiment, it will be observed that variations may be resorted to and are within the purview of the appended claims.

The present application is a division of our co-pending application Ser. No. 197,374, filed March 22, 1938.

HANS WALTER.
HERMANN SCHULZ.

Published July 13, 1943

Serial No. 274,857

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE WET MECHANICAL SEPARATION OF RAW MATERIALS

August Goette, Frankfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 29, 1939

My invention relates to an improvement in carrying out the wet mechanical separation of raw materials by contrivances or processes respectively which utilize for the separation the differences in the specific gravity of the components of such materials. Such improvement refers particularly to the process of separation which is carried out in jigs, in launder washers, by means of vertical stream washers or by the so-called sink and float process.

I have found that considerable advantage can be obtained when the above mentioned separation processes are carried out in the presence of substances which are known in flotation processes as "collectors" and which are capable of producing a selective flocculation of the specific lighter components of the material to be treated.

As regards the kind and quantity of the "collector" substance or substances to be added in accordance with my invention this depends in general upon the kind or the composition of the material to be treated. I have found, for instance, that for the treatment of ores such additional substances come into consideration as xanthates, eucalyptus oil or oleic acid. For the treatment of coal tar oils or pine oil may be applied whilst for other materials fatty acids. soaps, esters of fatty acids, sulfonated fatty acids and sulfonated higher aliphatic alcohols may be utilised. With special advantage such substances are utilised which are capable of effecting or facilitating the adherence of gas bubbles to the single flocculated particles of those components of the material which are specifically lighter.

The action of the said additional substances may consist therein that the specifically lighter components become hydrophobic in character by the flocculation or that they are charged with little gas bubbles, especially air bubbles. This latter action can be improved, as I have found, by providing for the presence of gases such as air in the liquid separating agent. Preferably considerable quantities of the gas should be present in the liquid or aqueous separating agent. This can be attained, for instance, by introducing gases such as air either continuously or discontinuously into the separating agent, for which inter alia water may be used.

Furthermore, in carrying out the process according to my invention I have found it advantageous when applying the additional substances that the formed flocks or the flocculated complexes mixed with gas bubbles should not be destroyed or that they should always be re-formed. For instance, I have found it advantageous when using jigs to keep the jig water in uniform movement by suitably adapting the number of revolutions and the lifting distances, or by a combination of both measures. The working conditions which are most favourable in each single instance can easily be ascertained by carrying out some preliminary experiments on a small scale.

By working according to my invention in the presence of the said additional auxiliary substances an improvement of the results hitherto obtained is effected. This improvement may be due to the fact that the addition of the auxiliary substances increases the efficacious difference in the specific gravity of the components to be separated. In the "sink and float" separating processes which work as is known with the aid of homogeneous or inhomogeneous stable or instable liquids or emulsions of higher specific gravity the application of substances according to my invention, in addition, results in the advantage that the higher viscosity which is often connected with the higher specific gravity does not show an effect towards the fine particles and, in consequence thereof, the separation even of the finer grain sizes may be carried out more quickly and readily.

The process according to my invention may be applied to all kinds of separators, the components of which show differences in the specific gravity either per se or after some suitable preliminary treatment. I have found that my invention is especially adapted for the separation of ores, coals, other mineral substances as well as salts and finely grained chemical substances.

I prefer to use jigs of the pan-American jig kind such as are recently used with the crushing circulation in the flotation of gold.

AUGUST GOETTE.

Published July 13, 1943

Serial No. 274,858

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE FLOTATION OF FLUOR SPAR

August Goette, Frankfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 20, 1939

My invention relates to a process for the flotation of fluor spar.

For the flotation of fluor spar which in general has the purpose to obtain as clean a concentrate of fluor spar as possible and to remove the natural materials accompanying this mineral such as quartz, heavy spar, sulfides and iron compounds, preferably such substances as oleic acid and its esters, pine oil, sulfonated aliphatic acids, tar oils and the like have been utilised.

Detailed experiments have shown that the flotation of fluor spar can be effected in a particularly good manner by using as flotation agent a mixture of sulfonated aliphatic hydroxy acids with sulfonated higher alcohols.

Sulfonated hydroxy acids of the aliphatic series are, for instance, sulfonated ricinoleic acid or its esters. With advantage such commercial products come into consideration as are used in the textile industry under the trade name "Turkey red oil."

As higher aliphatic alcohols such alcohols as heptadecyl alcohol, cetyl alcohol and the like may be used. Here again the commercial products may be used with advantage, for instance, such which consist in or contain as main constituents higher aliphatic alcohols, especially such, which are utilized in the textile industry. Instead of or in addition to sulfonated aliphatic alcohols substances of, for example, nearly the same chemical and physical structure as the textile auxiliary means, known by the trade-mark "Igepal" may be used.

The mixtures according to my invention are preferably composed in such a manner that they consist mainly in sulfonated hydroxy acids. In general, mixtures which contain about 80 to 99% of sulfonated hydroxy acids and about 1 to 20% of sulfonated aliphatic alcohols may be used with advantage. The composition of the mixture depends to a certain degree on the components of the material to be separated its proportions in quantity and in some cases also upon the properties of the water utilized in the flotation.

In certain cases other proportions in the composition of the mixture may come into consideration. The optimal proportions of the mixture can easily be ascertained by preliminary experiments carried out on a small scale.

The application of the flotation agent according to my invention offers the advantage that the flotation is effected more speedily and more thoroughly than by application of the hitherto known means for carrying out the flotation of fluor spar. By the use of equal amounts of chemicals the working according to my invention may be effected within a limited time with greater yields in fluor spar concentrates than by the hitherto known processes. Furthermore, the flotation agents according to my invention have the advantage that they are readily soluble in water so that they can be uniformly and completely distributed therein and in consequence thereof may also be dosed.

The flotation of fluor spar according to my invention is preferably effected at elevated temperatures such as, for instance, at about 30 to 50° C. The carrying out of the process at elevated temperatures permits in certain cases also a reduction of the quantity of the flotation agent to be applied. With multi step working the process can, if desired, be carried out in such a way that one step or a few steps only are effected at higher temperatures. My invention can also be applied with advantage to a combination of the use of separating tables and flotation. In this case, I proceed, for instance, in such a manner that the raw material mixed with water is stirred with the mixture of the flotation agents according to my invention and the aqueous mixture treated with the flotation agent is subjected subsequently in the ordinary way to the separation on the separating table. In this way it is possible to obtain a perfect separation even of such grain sizes which can not be treated by means of the generally used flotation agents.

AUGUST GOETTE.

Published July 13, 1943 Serial No. 275,513

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF EXTRACTING ALIPHATIC ACIDS, ESPECIALLY ACETIC ACID

Max Weimann, Frankfurt A/M, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 24, 1939

This invention relates to the manufacture of extracting aliphatic acids, especially acetic acid.

It is known to recover aliphatic acids by extracting in the counter current an aqueous solution thereof in columns provided with filling material, like Raschig rings, and by the aid of organic liquids, like ethyl-acetate.

According to my pending application Ser. No. 173,949 the aqueous liquid and the extraction liquid are passed through the apparatus with linear velocities which are generally greater than 0.2 cm pro sec. related to the total gross section of the column. To obtain the maximum extraction effect it was necessary to adjust the column to the desired through-put. When this throughput was lowered, the amount of acid in the aqueous wastes increased greatly and therefore the efficiency of the apparatus was undesirably decreased. On the other hand, when surpassing the upper limit of velocity the extraction effect was likewise decreased.

According to my invention it is possible to obtain excellent yields of extraction when working with different throughputs, only by regulating the height of the two liquid phases within the column. Therefore, when changing the throughput of liquids through the extraction column the level between the aqueous layer and the layer of extraction liquid, e. g. ethyl-acetate to such a degree, until the aqueous wastes contain only minimum amounts of acid. This favourable level is then maintained in a constant height as far as the throughput does not considerably alter.

The present invention is based on the new and surprising fact that the extraction effect depends not only from the diameter of the column but also from the height of the level between the two liquid phases within the column. Generally speaking, decreasing throughputs of the liquids require that the layer of that liquid is increased which is fed through the apparatus with the greater throughput. It is also necessary to increase the throughput of ethyl-acetate to an uneconomical degree. It was hitherto usual to maintain the aqueous layer at a certain height without respect to the desired throughput of liquids through the apparatus.

According to the present invention the extraction column is provided with devices indicating the level between the 2 liquids within the column reaching from the bottom to the top thereof. In that way it is possible to control the layers at any point in the interior of the column.

Hitherto it was usual to extract diluted acetic acid with ethyl-acetate in such a manner that the aqueous layer was only restricted to the lower part of the column, that is the part which was not filled with any filling material.

According to my invention, especially when lowering the throughput of the diluted acid the height level between acid and ester is increased into the space which is filled with filling material or even near the top of the extraction column.

Example

The column which was used, had a diameter of 1040 mm, a height of 10 m and was provided with cylindrical filling bodies of maximum 35 mm diameter. Into this column 4000 liters aqueous acetic acid of 17% and 1200 liters of ethyl-acetate were fed in the counter current in such a way that the layers of aqueous acid and ester were in the proportion of 1:9 and whereby the aqueous layer was beneath the zone of filling bodies. The contents of acid in the aqueous wastes was 0.06–0.08%, that is the yield of extraction, amounted to 99,3%. By exchanging the throughput of the above maintained diluted acetic acid to 2000 liters and in similar way to 6000 liters ethyl-acetate in the same apparatus the amount of acid in the aqueous wastes was increased over 1%. The extraction yield was therefor decreased to ca. 94%. When increasing the level between the two liquids in the column to such a degree that the layers of the aqueous liquid and the upper layer of ester were in the proportion of 3:1, and whereby the level was now within the zone of filling bodies the amount of acid in the aqueous wastes decreased below 0.1%, according to an extraction effect of 99.0–99.5%. This proportion between the two levels, which may in every case easily be obtained by controlling the acid amount in the aqueous wastes, is substantially maintained inasmuch as the throughput of liquids does not greatly alter.

The above described process may in similar way be performed when extracting other aliphatic acids with known organic solvents.

MAX WEIMANN.

Published July 13, 1943

Serial No. 276,021

ALIEN PROPERTY CUSTODIAN

EXTERMINATING AGENTS FOR ANIMAL VERMINS

Gerhard Peters, Frankfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 26, 1939

My invention relates to the extermination of animal pest-life of the most varied kinds, for instance, of warm-blooded obnoxious animals and insects, respectively.

According to my invention halogenated nitriles, such as for instance, trichloracetonitrile or trichlorpropionitrile, are extraordinarily well suited for this purpose.

Detailed experiments have shown that the above-mentioned substances, have shown that the above-mentioned substances, especially the chlorinated nitriles give surprisingly good effects. At the same time the danger of a harmful influence on human beings is considerably lessened by the fact that the presence of only small quantities of these substances causes already a strong irritation of the eyes but without doing any real harm. On the other hand this irritating effects has the advantage of driving out the vermin from their holes or hiding places respectively and this already with the slightest traces of the above mentioned substances. In consequence thereof the vermin is exposed in the open to the full infleunce (effect) of the exterminating agent and killed very easily. With warm-blooded animals, for instance, rats, the irritating effect has the further advantage that these animals do not perish in their hiding places, but come out before and consequently may be carried away easily after the extermination.

The distribution of the exterminating substances or their vapors in the rooms to be treated may be carried into effect in a known manner, for instance, by exposing the substances in vessels or by spilling them with the aid of suitable devices, or in any other suitable way.

The substances according to my invention may be used either alone or in mixture with other substances which may be likewise efficient or not. Liquid substances or their mixtures with other substances with insecticidal effect or not, may be utilized advantageously after a well known manner by absorption in suitable carriers, as for instance, wood-pulp, kieselguhr.

As the above mentioned substances do not tend to chemical conversion neither with the materials to be treated nor with the other substances for instance, metals, which may come into contact with the exterminating means or their vapors, no damage will occur in this respect.

In carrying out my invention it has been found especially advantageous to use halogenated nitriles in combination with other low boiling insecticides, as for instance, cyanogen chloride, ethylene oxide, methyl bromide, methyl iodide or the like. The substances according to my invention are especially suited for this purpose as they are able to mix with low boiling insecticides to a very considerable extent.

Exhaustive experiments have shown that mixtures of halogenated nitriles, such as trichloracetonitrile, with methyl bromide provide particularly valuable insecticidal properties. Thereby it has been found that effects may be attained which surpass considerably the expected effects based on the efficiency of the single components. Experiments with Tribolium confusum have shown that for a certain effect only two-thirds of the quantity of mixture were necessary which theoretically were calculated from the single effect of the components.

Exellent effects may be obtained, for instance, with a mixture of 40 parts of weight of methyl bromide with 60 parts of weight tri-chloracetonitril. whereby 100 parts of weight of this liquid mixture, for instance, may be absorbed in 100 to 120 parts of weight kiseleguhr or 40 to 50 parts of weight wood-pulp.

GERHARD PETERS.

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ALIEN PROPERTY CUSTODIAN

BENZINE HYDROCARBONS OF INCREASED KNOCK-PROOF

Friedrich Martin, Mulheim-Ruhr, Wilhelm Gottschall and Hermann Velde, Oberhausen-Holten, Germany; vested in the Alien Property Custodian

No Drawing. Application filed June 20, 1939

This invention relates to a method of increasing the knock-proof of benzine hydrocarbons and to benzine hydrocarbons having a correspondingly increased knock-proof.

It is known to liberate benzine hydrocarbons, with the aid of fuller's earths and other substances having a large inner surface, of impurities which tend to the formation of resinous substances. This refining process, which is mostly intended to replace the hitherto usual treatment with sulfuric acid, is carried out at relatively low temperatures of about 100–150° C. if normal pressure is employed and the hydrocarbons are treated in liquid phase. Higher temperatures were not employed, since under these conditions the purifying efficacy of the fuller's earth does not appear or drops too rapidly.

We have now discovered that fuller's earths, more particularly those activated by a treatment with an acid or containing small additions of aluminium chloride or polymerising catalysts of similar effect, such as zinc chloride, boron fluoride, phosphoric acid or iron chloride, are capable of materially increasing the knock-proof, if higher temperatures are used. Instead of fuller's earths other natural substances of large surface which contain silica or even silica gel or alumina may be employed.

With the aid of this new process the most various hydrocarbons may successfully be treated, for instance cracked benzines obtained from natural or synthetic hydrocarbons, benzines obtained by a polymerisation or benzines extracted from hydrocarbon gases by activated coal. The process is on principle designed for hydrocarbon mixtures which contain aliphatic olefines with straight chains. It is more particularly suitable for the treatment of hydrocarbons produced by the catalytic conversion of carbon monoxide and hydrogen. In this case the application of our new method is of great importance and its success very surprising, since the synthetic benzines produced by such a conversion, for instance according to the method of Fischer and Tropsch, mostly show a too low octane number. The process is of course not required for purely aromatic hydrocarbons since these substances possess already a satisfactory knock-proof.

The manner in which our new process may be carried out will now be illustrated more in detail by some examples which are not intended, however, to limit the scope of our invention in any way.

Example 1.—A primary benzine, which has been obtained by absorption with activated coal from hydrocarbon gases resulting in a catalytic conversion of carbon monoxide with hydrogen under a pressure of 7 atms. at a temperature of about 190° C., and which showed a specific weight of 0.692 and an octane number of 40 was passed at a temperature of 180–200° C. in a quantity of 30 liters hourly over 100 kgs. of fuller's earth activated by hydrochloric acid. The content in olefines of the starting material amounted to 41%. A benzine clear as water was obtained as end product which showed the same density of 0.692 and an octane number of 54.

By "primary benzine" we mean benzines which have been recovered by physical methods, for instance by a distillation or a stabilization, from the material indicated.

Example 2.—A stabilized primary benzine recovered by a hydrogenation of carbon monoxide under normal pressure at 190° C. was used as starting material. It showed a density of 0.691 and an octane number of 44, while it started boiling at 35–40° C. and had a boiling limit of 200° C. This material was passed at 180–200° C. with a velocity of hourly 40 liters in contact with 100 kgs. of an activated fuller's earth. An end product clear as water with an octane number of 51 was obtained in continuous operation.

Example 3.—A cracked benzine recovered from those primary products of a hydrogenation of carbon monoxide, which boiled between 200 and 233° C., by a thermic cracking treatment carried out under a pressure of 8 atms. at about 520° C. with a cracking period of about half a minute was used as starting material. This cracked benzine had a density of 0.720 and an octane number of 58, it had a light yellow color and contained about 80% olefines. 50 liters of this cracked benzine were hourly led at 300° C. over 100 kgs. of fuller's earth activated by sulfuric acid. A benzine clear as water and having an octane number of 78 was obtained as end product.

Example 4.—As starting material served a benzine obtained similarly as explained with reference to Example 3 by the cracking of primary products obtained in a benzine synthesis according to Fischer and Tropsch. This benzine showed a light yellow color, a specific weight of 0.724 and an octane number of 61.5. The cracked benzine was passed at a temperature of 180–200° C. in a quantity of hourly 25 liters over 100 kgs. of a silica gel to which some aluminium chloride was added. A product clear as water was obtained which possessed an octane number of 73.5.

Example 5.—A cracked benzine which showed an upper boiling limit of 200° C. and which con-

tained 70% olefines was treated at 250° C. with an activated fuller's earth recovered from Bavarian bleaching clays by means of sulfuric acid. The octane number was thus improved from 65 to 77. After some time the capability of the fuller's earth to increase the octane number dropped so that the octane number of the starting material was increased only to about 70 when about 100 kgs. of the cracked benzine had been treated per kilogram of the fuller's earth.

Example 6.—A cracked benzine obtained in a similar manner as the starting material mentioned in Example 4 was treated at 200° C. with silica gel. An end product clear as water having a specific weight of 0.725 and an octane number of 70 was obtained.

Example 7.—A gas oil fraction of the primary products of the synthesis of benzine from carbon monoxide and hydrogen, which had a boiling range of 200–330° C. was cracked under gentle conditions, viz. in a pipe furnace under a pressure of about 8 atms. above normal and at a temperature of 520° C. in such manner that the material remained for 30 seconds in the reaction zone. A benzine of the specific weight of 7.20 which contained preponderably mono-olefines and possessed an upper boiling limit of 200° C. and an octane value of 58, was obtained in a yield of 75%. This cracking benzine was treated at 250–400° C. with fuller's earth. The octane number was thereby increased to about 78, while only about 25% were converted into gases, i. e. into products which were gaseous under normal conditions of temperatures (20° C.) and pressure. When the same gas oil fraction was cracked under severe conditions, for instance under a pressure of 8 atms. above normal, at 540° C. and with a reaction period of 300 seconds, the yield amounted only to 65%, while 35% were converted into gases.

The following general conditions of operation may be given, which show the manner in which our invention can be put into practice.

The highest value is approximately attained when about 50–60 kgs. benzine have passed one kg. of the fuller's earth or the other active material employed. When about 100 kgs. benzine have passed 1 kg. fuller's earth, we may attain about 40% of the highest value. These figures show approximately in which manner the efficacy of the fuller's earths drops in the course of the operation.

The treatment with fuller's earth for the improvement of the octane number may also be carried out at temperatures which exceed the temperature limits mentioned in the examples given above.

The operating temperature will advantageously be increased more particularly when the effect of the fuller's earth used with respect to the improvement of the octane number diminishes. Temperatures of 300–400° C. may be employed after a more extended use of the fuller's earth.

It is advantageous to perform the increase of temperature which is required by the drop of the effect of the fuller's earth in improving the octane number, only gradually and from batch to batch. In this case no cracking worth speaking of occurs nor is any remarkable quantity of the material lost by the formation of gases. If the temperature is increased too rapidly, the fuller's earth would have so high an activity in the individual treating stages that a substantial part of the hydrocarbons would be cracked so that a large quantity of hydrocarbons would be formed which are gaseous under normal conditions of temperature and pressure.

Even if the operating temperature is increased only slowly and carefully, it cannot always be avoided with certainty that the benzines recovered in the treatment with the fuller's earth are slightly discolored. These discolored products may subsequently be subjected to a refining treatment.

Not all known fuller's earths are suitable for increasing the octane number to the same extent. We have found that the earths activated by hydrochloric acid or sulfuric acid are most useful. We have found excellently suited for instance those fuller's earths which are recovered from Bavarian clay products by a treatment with acids, such as the products which are on the market under the trade names "Granosil" or "Tonsil".

The operating temperature must be adjusted within the range specified above to the specific fuller's earth or the other specific active material employed as well as to the time during which this material has already been used and to the starting benzine under treatment.

The effect of the fuller's earths and the similar materials mentioned above is not bound to a specific limit of the pressure. We are therefore enabled to even operate under any optional pressure above normal, but generally operate in gaseous phase.

The lower limit of the velocity with which the hydrocarbons under treatment are contacted with the active material may be determined merely in accordance with economic considerations, since we succeed in the improvement of the knocking qualities of the various starting materials, and may thus obtain therefrom highly knock-proof benzine, even if very low velocities are employed. The velocity can advantageously be increased to such an extent that for instance 30–40 liters of the starting benzine are hourly contacted with 100 kgs. of the fuller's earth. We may, however, pass even as much as 90 liters or more of the starting benzine hourly with 100 kgs. of the contact substances.

The following modification, amongst others, is of great practical importance.

Hitherto when it was intended to produce highly knock-proof fuels from hydrocarbon mixtures mainly containing saturated paraffinic hydrocarbons, one was compelled to conduct the cracking operation in such manner that a large proportion of aromatic hydrocarbons was formed in order to attain the high knock-proof required. This aim could be reached only by the use of rigorous or severe cracking conditions which, however, led to the formation of large quantities of methane and other hydrocarbons which are gaseous under normal conditions of pressure and temperature. When gentle cracking conditions are employed, in order to reduce these losses caused by the formation of gaseous hydrocarbons, the cracked benzines produced are not satisfactorily knock-proof. According to the present invention it is however possible to employ gentle cracking conditions, which lead in dependency on the boiling range of the starting material for instance to the formation of 75–80% or even more than 90% olefines, and thus to materially reduce the losses suffered by the formation of the gaseous hydrocarbons mentioned, while nevertheless a satisfactory octane value may be obtained. To this end we subject the products obtained in the cracking under gentle conditions, of a mixture

mainly consisting of paraffinic hydrocarbons, to an additional subsequent treatment with fuller's earth or similar materials in the manner described above.

Even the benzines recovered by the cracking, under rigorous conditions, of such mixtures mainly comprising paraffinic hydrocarbons may be improved with regard to their octane value by a treatment in accordance with the present invention. The benzines obtained in a cracking treatment carried out under gentle conditions contain, however, a considerably larger percentage of constituents which are capable of being improved so that the yield is materially better when gentle cracking conditions are employed, as shown by Example 7 mentioned above.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

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ALIEN PROPERTY CUSTODIAN

REFINING OF BENZINE HYDROCARBONS

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This invention relates to a method of refining hydrocarbon mixtures, more particularly for liberating them from substances capable of forming resinous or coloring matter.

It is an object of our invention to treat for this purpose hydrocarbons and mixtures thereof by means of fuller's earths and similar materials which have a large inner surface, and more particularly with materials of this kind which have already been employed for another treatment of hydrocarbons, more especially for such a treatment by which the octane number of hydrocarbons or their mixtures has been increased

Other objects of our invention will appear as the specification proceeds.

In our copending application for "Benzine hydrocarbons of increased knock-proof," executed on even date with this application, we have disclosed that the knock-proof of hydrocarbons of the most various kinds can be improved and their octane values increased by treating them with fuller's earths, preferably with fuller's earths activated by hydrochloric or sulfuric acid or other acids or by an admixture of polymerising catalysts such as aluminium chloride, zinc chloride, boron fluoride, iron chloride or phosphoric acid, or by treating said hydrocarbons with other materials of large inner surface, such as silica gel or alumina, at a temperature of about 150–400° C which exceeds in every case the temperature at which these fuller's earths and similar materials are capable of liberating the hydrocarbon mixtures of this kind from impurities which lead to the formation of resinous or coloring substances. To this treatment at relatively high temperatures there may successively be subjected for instance cracked benzines recovered from natural or synthetic hydrocarbons, benzines recovered by a polymerization, benzines recovered from hydrocarbon gases with the aid of activated coal, and more particularly aliphatic olefines with straight chains and mixtures containing same. To these materials belong for instance the primary products of the benzine synthesis according to Fischer and Tropsch, i. e. the products which are recovered by merely physical methods, such as distillation or stabilization, from the products of the catalytic conversion of carbon monoxide and hydrogen. Instead of or in addition to these primary products there may be used as starting materials secondary products obtained therefrom by any subsequent treatment, for instance by a treatment with activated coal or by a distillation or a cracking treatment. The improvement of the knock-proof is particularly important for the benzines which have been cracked under gentle conditions, for instance under a pressure of 4–15 atmospheres at a temperature above 400° C and preferably between 500 and 550° C with a cracking period of about half a minute, as disclosed more in detail in said copending application. In this treatment with fuller's earths or the other materials mentioned above the temperature may gradually be increased, while the treatment proceeds, more particularly when the capability of the fuller's earth or similar materials of increasing the octane value of the hydrocarbons under treatment diminishes or ceases. A temperature of 400° C is, as a rule, not overstepped, since at higher temperatures the organic material may be decomposed. Even at the highest temperature, which is thus possible, the capability of the fuller's earths or similar materials of improving the octane value is, however, practically exhausted after some time.

We have now found that the activity of these fuller's earths and other materials is, however, not yet exhausted at this stage. The said materials are in this stage according to our discovery excellently suitable to absorb impurities which may cause the formation of resinous or coloring substances, and more particularly to absorb them from the hydrocarbon materials specified above. These hydrocarbon materials are in many cases somewhat discolored after they have been subjected to the treatment with fuller's earths or similar materials, having large inner surfaces at relatively high temperatures for the purpose of increasing their octane value. They may now be refined and liberated from the coloring impurities by a subsequent treatment with fuller's earths, more particularly activated fuller's earths, or the other materials with large inner surfaces specified above, which beforehand have been employed for a treatment at relatively high temperatures in accordance with our copending application mentioned above until their capacity of increasing the octane value appeared to be exhausted.

In order to carry out this refining treatment, we prefer to first extract with suitable solvents, such as benzene, benzine or carbon tetrachloride, the fuller's earths or similar materials, with which a hydrocarbon material, as specified above, had been treated at a relatively high temperature for the increase of its octane value. The fuller's earths or similar materials thus extracted are applied to the hydrocarbon mixture to be refined at temperatures between about 100 and 160° C in the manner which is hitherto employed when

benzine hydrocarbons shall be liberated by active fuller's earths from substances tending to the formation of resins. As solvent for the previous extraction of the fuller's earths or similar materials there may also be employed a benzine material which has already been refined according to the present invention.

Example 1.—A cracked benzine recovered by a heat treatment at about 520° C. and under a pressure of 8 atms. from those primary products of a hydrogenation of carbon monoxides, which boiled between 200 and 330° C., was used as starting material. This cracked benzine showed a density of 0.720 and an octane number of 58. At a temperature of 300° C. 50 liters of this benzine were passed in contact with 100 kgs. of a fuller's earth activated with sulfuric acid. The end product had an octane number of 78, but after some time showed a light yellow color.

This benzine was now passed at 140° C. with a velocity of hourly 40 liters in contact with 100 kgs. of a fuller's earth, which was previously employed for the treatment at the higher temperature for the increase of the octane number until the capacity of the fuller's earth to improve the knock-proof appeared exhausted. In this stage the earth was washed out with benzine and dried before it was used for the treatment of the benzine at 140° C. The benzine refined with the aid of this extracted and dried fuller's earth was found to be altogether clear and not to grow discolored.

Example 2.—A cracked benzine which contained 70% olefines and showed an upper boiling limit of 200° C. was treated at 250° C. with a fuller's earth activated by hydrochloric acid. By this first stage of the process the octane number of the benzine was increased from 65 to 77. The end product obtained showed, however, a light yellow color. It was now conducted, in a second stage, at 130° C. with a flowing velocity of hourly 30 liters over 90 kgs. of the fuller's earth which had been employed in the first stage. This fuller's earth, which showed to be not any longer capable of increasing the octane number, was washed out with benzine and was only thereupon used for the removal of the resinous constituents from the benzine obtained in the first stage. The end product obtained in the second stage was clear as water and did not become discolored even after a long time.

Anyone of the hydrocarbon materials mentioned above and disclosed in our copending application may be treated on principle in the same manner in two stages, so that first its octane value is increased and thereupon the material refined. In the first stage all the details disclosed in our copending application mentioned above may be applied.

The fuller's earths activated by hydrochloric acid or sulfuric acid, and more particularly such fuller's earths recovered from Bavarian clay products by a treatment with acids, have been found to be particularly suitable also for the process according to the present invention.

While all the hydrocarbon materials mentioned above and more particularly the primary or secondary products of the benzine synthesis carried out according to the method of Fischer and Tropsch, may advantageously be subjected to the two-stage treatment according to our invention, this treatment is of particular advantage if applied to benzine hydrocarbons obtained by a cracking under gentle conditions. For this cracking treatment results with a minimum of losses in a material with a relatively low octane value which may materially be increased by the first treatment with fuller's earth at high temperature, while the impurities then contained in the thus improved mixture may easily be removed by a second treatment at relatively low temperature with the fuller's earth which had been served for the first stage until its capacity of increasing the octane value of the hydrocarbon mixture was substantially exhausted.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

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ALIEN PROPERTY CUSTODIAN

HEAT EXCHANGE APPARATUS

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Application filed July 6, 1939

This invention is directed to apparatus for absorbing heat from specially shaped exhaust conduits so that the heat can be used in other parts of an air craft, for example, in heating the cabin of the aircraft or for heating the de-icing devices.

In aircraft engines having exhaust conduits designed as nozzles for the purpose of obtaining a recoil action from the gases emitted from the nozzles for the purpose of aiding in the forward propulsion of the aircraft, considerable importance is placed upon the cooling of the conduits. Because of their relatively short length, and because of the gas pressures and high temperatures developed in them, by reason of their nozzle shape, great care must be taken in the cooling to prevent deformation and destruction of the nozzles with a consequent loss in the efficiency of recoil. Prior structures merely exposed the nozzles to a cooling medium such as the air stream passing the aircraft, whereas it is an object of this invention to construct an apparatus for the more effective application of a cooling medium to the highly heated nozzles, so that better cooling of the nozzles is obtained while at the same time sufficient heat is absorbed by the cooling medium to render the now heated medium useful for other purposes, such as for heating the aircraft cabin, or de-icing apparatus.

It is an object of the invention to construct a novel and simple apparatus for applying a cooling medium to recoil exhaust conduits for the absorption of heat therefrom.

A further object of the invention is to construct a heat exchange system including the exhaust conduits of an aircraft engine in which leakage of the exhaust from the conduits is prevented.

Another object of the invention is to cool the exhaust conduits which extend from individual cylinders of an engine by passing the cooling medium transversely of the direction taken by the gases in the exhaust conduits, one cooling system being common to all of the individual exhaust conduits.

Another object of the invention is to provide special fin constructions in order to obtain a more efficient heat exchaneg action between the conduits and the cooling medium.

The objects of the instant invention are obtained by forming the heat exchange conduits as tubes directing the flow of the cooling medium, such as air, against confined areas of the recoil exhaust nozzles, with the advantage that sufficient heat is absorbed so that the cooling medium can be used for other purposes, such as the heating of the cabin of an aircraft, or the heating of de-icing apparatus.

The means by which the objects of the invention may be obtained are more fully described in the following specification taken in connection with the accompanying drawings, in which:

Fig. 1 is a sectional view showing the use of one conduit for cooling successively a plurality of exhaust conduits.

Figs. 2 and 3 are similar views showing modified forms of conduits for cooling the recoil exhaust nozzles with separate streams of air.

Fig. 4 is a view similar to Fig. 1 showing means for obtaining a tight joint between cooling conduits and the individual exhaust conduits.

Fig. 5 is a similar view showing the use of special baffles between the exhaust conduits for effecting a more efficient cooling thereof; and

Fig. 6 is a similar view showing the use of fins to effect a more efficient cooling of the exhaust conduits.

In Fig. 1, individual exhaust conduits **2** are shown extending from the wall **4** of a motor; conduits **2** of course being connected to the exhaust ports of the various combustion chambers of the motor. Conduits **2** are of special construction and are curved rearwardly to form at their ends nozzles which produce a recoil effect to aid in the forward propulsion of the aircraft.

An air duct **6** successively traverses each of the conduits **2**. This duct **6** is open at its forward end for the entrance of air which passes by each individual conduit **2**, and is discharged from the rear end of the conduit, as indicated by the arrows. It is noted that the passage of the cooling air is substantially as right angles to the direction of the passage of the gases through the individual exhaust conduits. This provides a very efficient means of cooling these relatively short conduits **2** as air forced through duct **6** impinges with increased pressure upon conduit **2**. Air having been heated through the absorption of heat from walls of the conduits, can be conducted to the interior of the cabin of the aircraft for the purpose of heating the same, or can be used for heating de-icing apparatus.

In Fig. 2, a second form of conduit is shown in which air is admitted into the duct **8** which is closed at one end **10**. The individual exhaust conduits **2** are connected to duct **8** by individual manifolds **12**, the air entering duct **8** being aided in its passage through manifolds **12** by baffles **14**. The air leaves manifolds **14**, and passes into duct **16** from which it is conducted to any point of use.

Duct 16 is closed at one end 18, and the movement of the air entering the conduit 16 is facilitated by baffles 20. In this construction as in Fig. 1, the gases are passing at right angles to the direction of flow of the cooling air.

An arrangement somewhat similar to that shown in Fig. 2 is illustrated in Fig. 3. Therein, duct 22 is common to all the exhaust conduits 2; duct 22 being closed at one end 24. Air not only passes transversely of the direction of flow of gas in the conduits 2, but further travels in a direction opposite the direction of flow of the gases in exhaust conduits 2 by being passed through manifolds 26, each of which encloses a portion of the length of an exhaust conduit 2. Manifolds 26 empty into duct 28 closed at one end 30 from which heated air is conducted to a point of use. In this arrangement substantially the entire length of the short exhaust conduits 2 is enclosed by the ducts 22 and 28, and connecting manifolds 26. Consequently substantially the entire length of each exhaust conduit 2 is subjected to the cooling air.

In Fig. 4 a joint structure between the duct 6 and the individual exhaust conduits 2 is shown. Spaced annular flanges 31 and 32 surround each exhaust conduit 2, and a wall of duct 6 is clamped between these flanges. This construction enables the use of conduits 2 which need not be of seamless tube construction, inasmuch as the surrounding joint employed prevents the entrance of gas which may leak from a welded tube forming a nozzle extending through the duct 6.

In Fig. 5 the duct 6 is again shown extending transversely of the individual exhaust conduits 2. In between adjacent exhaust conduits 2 are placed arcuately shaped baffles 34 which are convex toward the interior of duct 6 and constrict the passageway of duct 6 between adjacent individual exhaust conduits, and accordingly produce an increase of pressure against the walls of the exhaust conduits, which in turn creates a better cooling action, or a more efficient heat exchange between the walls of the exhaust conduits and the cooling air.

In Fig. 6 the exhaust conduits 2 are again traversed by duct 6. In order to facilitate the heat exchange between the walls of exhaust conduits 2 and the cooling medium, a plurality of annular fins 36 are secured to each exhaust conduit 2 within duct 6, and in the path of the cooling air.

By the above constructions the short exhaust conduits which are constructed as recoil nozzles, are kept from overheating so that the material forming the nozzle shaped conduits does not distort, and by such distortion cause a loss of efficiency in the recoil action. By the use of the air conduits shown, the heat contained in the exhaust conduits can be transferred to a cooling medium, and used for other purposes, as for the heating of an engine or the prevention of the icing of the wings. By using the construction of Fig. 4, it is not necessary to use seamless tubing for the construction of the exhaust conduits as the connecting flanges form an efficient sealing construction to prevent leakage of gases from the exhaust conduit into the cooling medium.

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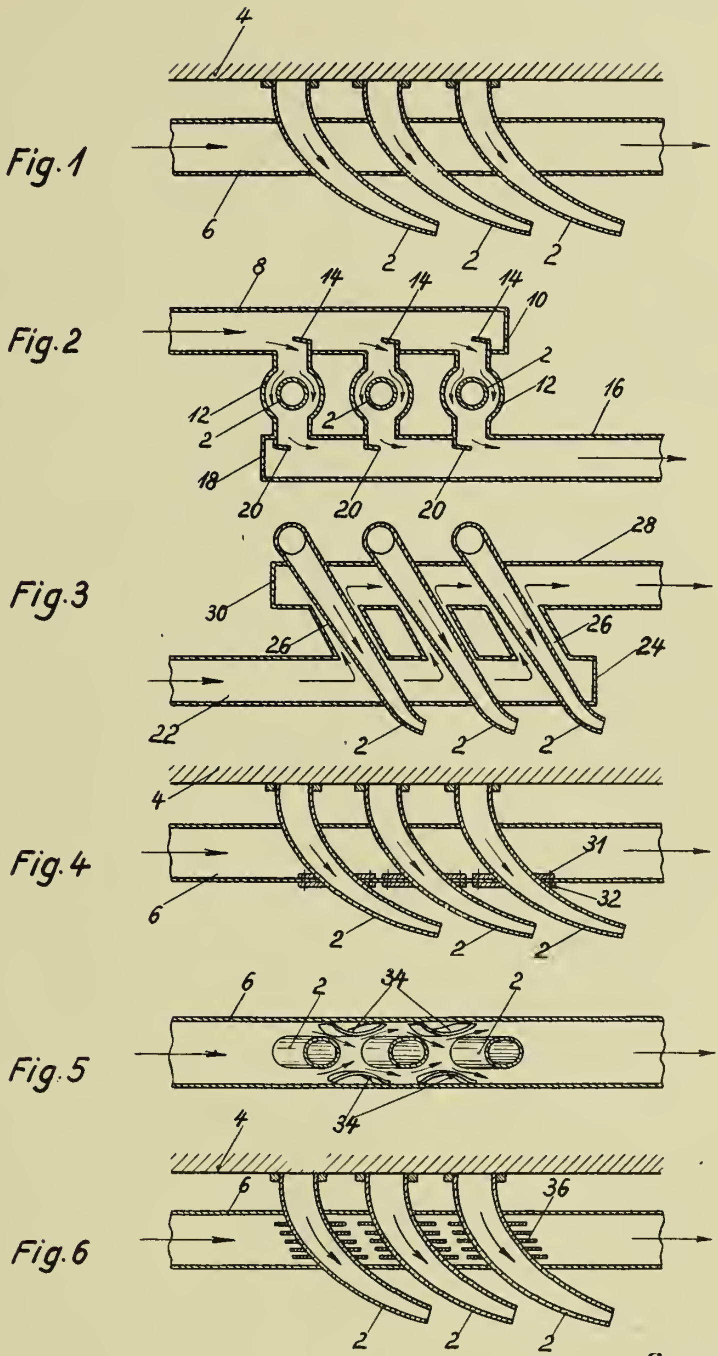

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ALIEN PROPERTY CUSTODIAN

CONSTRUCTION OF FUSELAGES

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The present invention relates to aerodynamic structures or surfaces, especially for aerial navigation machines, and it is more especially, although not exclusively, concerned, among these structures, with those of the stressed skin type, in which the skin or covering proper must be intimately assembled to a carcass or skeleton including longitudinal elements (stringers, longitudinal bars, etc.) and transverse elements (frames, formers, etc.). It should be well understood that these structures may consist either of fuselages, nacelles and the like, or of wings and the like.

The chief object of the present invention is to permit of forming these structures in a more methodic and rational manner than it was done up to this time, thus reducing the time and cost of manufacture, while increasing the resistance and safety rate owing to the perfection obtained in the assembly of the constituting elements.

According to an essential feature of the present invention, the assembling operations are performed by means of positioning devices capable, both of supporting, at least temporarily, the various elements to be assembled together, and of fixing in an accurate manner, through a predetermined marking, the relative positions that these elements are intended to occupy in the assembly, these devices being also eventually adapted to act as supports for the riveting or welding apparatus.

According to another feature of the present invention, in order to make structures of the type above described including a skin or covering, stringers, and transverse frames or formers or the like, I separately prepare, on the one hand the skin and the stringers assembled therewith, and, on the other hand, the transverse frames or formers (eventually with the internal structure elements to be fixed thereto) and then I adapt the stringer and covering assemblies around said transverse elements, after which the whole is assembled together.

According to still another feature of the present invention, in order to perform the assembling operations involved, in particular, by the fixation of the skin or covering on longitudinal parts such as the stringers, the pieces are supported, while the mounting takes place, by a carcass adapted to the shape which is to be given to the covering in the finished structure, said carcass being itself mounted pivotally about a longitudinal axis, the whole being advantageously such that, owing to the displacements of the carcass, the successive operations of assembly of the various parts can take place substantially at the same height.

According to still another feature of the present invention, concerning the case in which the structure includes developable surfaces, the mounting of the stringers, and eventually also of the means (gussets, angle plates, etc.) capable of ensuring the fixation of the transverse elements (frames, formers, etc.) on a plane surface, by starting from developed metal sheet elements, the whole being subsequently formed in such manner as to obtain the developable surface to be included in the final structure.

Still another feature of the present invention relates to the method of assembling the carcass or skeleton of the structure with the covering or skin and/or the stringers, and it consists in bringing and maintaining said skin or covering, for the assembly, exactly in the form it must have in the finished structure, for instance by engagement against a berth of corresponding shape.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic elevation of an airplane the fuselage of which is made of several portions or sections which may be made according to the present invention;

Figs. 2 and 3 are, respectively, an elevation and a cross section of a device for mounting the covering or skin and the stringers, in particular those of section II of Fig. 1, according to the invention;

Figs. 4 and 5 separately show, on an enlarged scale, respectively in elevation (with parts cut away) and in transverse section, some elements of the mounting system in question, and in particular a plate or band for the positioning of the stringers, according to the invention;

Figs. 6 and 7 separately show, also on an enlarged scale, respectively in plane view, with parts in section and in section on the line VII—VII of Fig. 6, some of the other elements of said system;

Figs. 8 and 9 show, respectively in elevation and in section, another system of the same kind, for the mounting of developable sections, in particular section III of Fig. 1, according to the invention;

Figs. 10 to 12 show, separately and on an enlarged scale, respectively in elevation, in horizontal section and in section by the line XII—XII

of Fig. 10, certain elements of said system, made according to the invention;

Figs. 13 to 15 show, respectively in elevation, in plan view and in transverse section, a mounting system according to the invention;

Fig. 15*a* shows, separately on an enlarged scale, a tightening device for use in said system, according to the invention;

Figs. 16 and 17 show, on an enlarged scale, respectively in elevation and in section on the line XVII—XVII of Fig. 16, devices for the positioning of fixation angle plates;

Figs. 18 and 19 show, in a similar manner, devices of the same kind, for the mounting of longitudinal bars included in the covering;

Figs. 20 to 22 show, separately and on an enlarged scale, certain other elements of the system of Figs. 13 to 15;

Fig. 23 diagrammatically shows, in developed plan view, the whole of a covering, stringers and angle plates, the whole being assembled as shown by the preceding Figs.;

Fig. 24 shows, in diagrammatic section, another device for the mounting of the angle plates on a developed skin or covering, made according to a modification of the invention;

Figs. 25 to 27 show, the two first in elevation, partly in section, in two different positions, the third in end view on an enlarged scale, a system for assembling on transverse frames and formers, systems including the covering, stringers and angle plates, for instance for section III of Fig. 1;

Fig. 28 shows, in section a part of said system, during the setting in position of the transverse frames and formers;

Figs. 29 to 31 are partial views, on an enlarged scale, respectively in elevation and in section on the line XXX—XXX in two different positions, devices for positioning the formers, according to the present invention;

Figs. 32 and 33 show, respectively in elevation and in transverse section, and in plan view, the whole of a former and the means for making it, such an assembly being made according to a prior application and being advantageously used in connection with the present invention.

According to the invention, as exemplified by the embodiments illustrated by the drawings, it is desired to make an airplane fuselage constituted by several sections adapted to be made separately, as set forth in some of my prior applications, and in particular the French patent application Ser. No. 441,519 of Feb. 4, 1939. For instance, there are five sections, I, II, III, IV, V (Fig. 1) the first of which is located ahead of wing 76, the second (generally of curved longitudinal section) at the level of the wing, provided, for instance, at its lower part with an aperture for a baggage, parachute, bomb or other compartment, the third, preferably of conical shape, between the preceding one and the tail unit, the fourth carrying this tail unit, and finally the fifth forming the rear end of the fuselage. The whole is preferably of circular cross section.

These various sections of the fuselage are constituted by the combination of a skin or covering 2 (Figs. 1 and 3) and of a carcass or skeleton capable of working in cooperation with said skin and including, on the one hand, a plurality of longitudinal elements which will be preferably fixed, over at least a portion of their length, on the metal sheets 2 of the skin, these elements being represented on the drawings by sectional irons or stringers 3 (Figs. 1 and 3) advantageously of S-shaped, Z-shaped or similar section, and also, at least for some sections, by longitudinal bars 4 which reinforce the whole and which may further serve to rigidify the assembly between two successive sections (such as II and III in particular).

Furthermore, there are transverse elements, such as transverse frames or formers, intended to be fixed on both the stringers and the skin (frames 5 of Fig. 1) or only on the stringers (formers 6 of Figs. 1 and 28 to 31).

These frames and formers can be made in many ways, including for instance a sectional iron of the same section as the stringers, and they may extend over 360° (as in the case of section III) or on the contrary, they may be interrupted at certain places where there are apertures in the fuselage (as in section II). They may further be fixed on the side of the inside of the fuselage, with any complementary structures. For instance, in section II, they are assembled with a floor 7 (Fig. 1 in dotted lines) intended, as indicated in a prior patent application Ser. No. 441,856, filed Feb. 11, 1939, to reestablish the continuity of the fuselage interrupted by door 1.

It will be supposed in the following description that the elements are assembled by riveting and are made for instance of duralumin, but of course the invention would apply also to the case of structures including parts of stainless steel and adapted to be assembled together by continuous or discontinuous welding.

As above stated, according to an important characteristic of the invention, positioning means are provided for both supporting the elements for the assembly and fitting them in the proper relative position. These positioning means may be employed at each of the steps of the manufacture, whatever be the order in which the parts are assembled together.

However, according to another feature of the invention, it is advantageous to proceed in such manner as to produce separately, on the one hand systems including the skin proper, together with its longitudinal elements and also, preferably, the means for effecting the assembly with the transverse frames or formers (said means including, for instance, gussets or angle plates 8 as shown by Figs. 13, 16 to 19, 29 to 31) and, on the other hand said transverse frames or formers eventually assembled together with auxiliary structures such as floor 7 and part or the whole of means of fixation with the skin and stringer unit, and these last mentioned units are brought around the frames or formers and fixed thereto.

It will be supposed, in the following description that this method is employed, and this leads to describe first the method for constructing the skin and assembling the stringers therewith, then the method for the fixation of the angle irons, and finally that for the mounting and assembly of the frames and formers.

Concerning the construction of the skin and stringer units, I make use of positioning means arranged in such manner as to permit the following possibilities:

a. Maintaining the elementary metal sheets 2 the juxtaposition of which constitutes the skin, these metal sheets being cut in advance in any suitable manner with, eventually (for instance in the case of section II) a shaping into the desired form (by stamping or otherwise) and also eventually with the driving of the rivet holes;

b. Maintaining also the stringers 3, either all

simultaneously or, preferably, successively as they are being fixed in position, these stringers having been previously provided with holes;

c. Advantageously, guiding the riveting apparatus (or the welding apparatus, as the case may be).

For instance, these positioning means are made as follows:

On the one hand, there is a frame 9, 10 (Figs. 2 and 5, or 8 to 12) on which metal sheets 2 can be successively adapted. On the other hand, there is at least one band or plate 11, adapted to be used as temporary support for at least one of the stringers, this band being therefore capable of occupying, with reference to said frame 9, 10, several relative positions which are accurately determined. Finally, means are provided for ensuring the temporary fixation of the metal sheets or stringers on their supports.

Preferably (but not exclusively, as it will result from the description of Figs. 8 to 12) the whole is given a shape corresponding to that to be given to the skin of the fuselage, which is of course necessary in the case of a section of the shape of section II.

In this latter case, it is advantageous to arrange the system above described in such manner that it can pivot about a longitudinal shaft 12, being if necessary balanced by a counterweight, such an arrangement permitting, among other advantages, of working on a band 11 which is always located substantially at the same level.

As shown by way of example by Figs. 2 to 7, this carcass includes an L-sectional iron 9, from which the work is started, and several transverse bent bars 10, for instance two at the respective ends and one at the middle, the whole being carried by a pivoting support including several transverse plates 14 mounted on shaft or hub 12, with bracing members 15 interconnecting them. This hub, supported by rollers 16 is advantageously eccentric with respect to the axis of revolution of the skin or covering (that is to say the axis coinciding with the centers of curved members 10) in such manner as to facilitate the work. Finally, it has been supposed that the bent members 10 extend over portions of circumferences smaller than 180°, which corresponds to portions of covering of section II. But, of course, they might extend over portions corresponding to 180°, for instance for the construction of section III.

It is along these curved member 10 that band 11 must be displaced. Preferably, this band 11 is divided into two distinct elements which are shown of curved or rounded shape, so as to correspond to the shape of section II. In order to determine the exact relative positions of these two elements, I make use, for instance, of spindles 17 carried by said bands 11 and adapted to engage in holes 18 provided in curved members 10.

The bands 11 are for instance provided, at each of their ends, with two spindles 17^1, 17^2 at least one of which, to wit 17^1 is mounted against the action of spring 73. At the time of the mounting, the workmen can thus first engage spring spindles 17^1 into the corresponding holes 18 (Figs. 4 and 5) after which they cause the band 11 to pivot about the axis of said spindles. When it has been brought into its correct position against metal sheet 2, the other spindles or pins 17^2 are located opposite their holes and they must be driven thereinto. They act as locking means. These spindles or pins 17^2, might themselves be spring mounted, with a bayonet device which would permit of keeping them away from the band, prior to the locking.

Of course, the bands 11 are given a shape such, and they are fitted with means such, that they can support stringers 3 and permit the riveting work.

For this purpose, for instance, on the one hand, these bands 11 are provided with a groove 19 against which it is possible to apply in correct position stringers 3 (Figs. 4 and 5), in combination with compressing means, such as hooks 20, provided with springs 21.

On the other hand, in order to ensure the guiding of the riveting apparatus 22, I provide, for instance, rolling tracks along a ridge 23, against which rolling tracks run rollers 24 of the apparatus in question.

The pivoting carcass thus made is completed by means for holding metal sheets 2, on the one hand, against bent members 10 and, on the other hand, against bottom iron 9 (for the first metal sheet), these means consisting for instance of lugs 25, 26, with tightening bolts 27, 28 (Figs. 6 and 7). The bent members 11 are further provided with recesses 29 for the passage of the stringers (Fig. 5).

Finally, the pivoting carcass is supported by a fixed frame 30, 31, including at its upper part a roller track 32 for carrying the riveting apparatus.

I thus obtain a device which permits of carrying out the mounting and the assembly, both of the metal sheets together and of the stringers with the metal sheets, in the minimum of time and with an accuracy which had never been obtained up to this time.

The first sheet 2 being fixed on sectional iron 9 and on bent members 10, the riveting is effected successively along the various lines of rivets corresponding to the stringers, by making use of bands 11, which are displaced, for each operation. Then the next metal sheet is posed (the joint being of the overlapping type as visible at 33, Fig. 5), and so on. Eventually, the movements of displacement of the bands 11 might be conjugated with the displacements of rotation of the pivoting carcass.

It goes without saying that the method above described might be applied to the driving of holes through the metal sheets and the stringers or to any other operation to be performed on these elements. I might also, instead of riveting on the said carcass, only effect a securing of the parts together (by means for instance of some screws and nuts), the riveting being performed on another machine.

I might also, instead of utilizing, as shown by the drawings, one or several manually operated riveting machines, apply the method just above specified to an automatic riveting machine such as above described in a prior patent application and including a stationary comb-like element intended to support the metal sheets and stringers, along which element can move one of several carriages provided with driving and riveting tools. According to said method, the function of the comb-like element might be performed by band 11, arranged in a suitable manner and which can then be fixed. With this fixed comb-like member, might coact a carcass 9, 10 which would be displaced relatively to said comb-like member every time a line of rivets would be finished, and which would thus permit of exactly positioning the metal sheet and stringer of the next line of rivets. This carcass might be piv-

oting as above or, on the contrary, displaceable with a translatory movement, if the work is carried out along a plane surface as it will now be explained.

In Figs. 8 to 12, I have shown as it is possible, in the case of developable surfaces, (for instance for section III, Fig. 1, if it is of conical shape) to carry out the method according to the invention in a plane surface.

In this application, carcass **9**, **10** will be carried by a flat surface **34**[1], for instance hanging vertically, or even slightly obliquely, from a support **34**. In this case, stringers **10** are arranged in the plane according to the lines of development of the bases or sections of one half of a cone (along 180° of profile). The same positioning members (band **11**) fixation members and assembling members can be employed and in Figs. 8 to 12, they are designated by the same reference numbers as in Figs. 2 to 7.

If, as supposed in the case of Figs. 8 to 12, the carcass is stationary, supports or platforms **35**, guided at **36**, are provided for enabling the workmen to work along the lines of rivets. But it would also be possible to work at constant height by displacing carcass **9**, **10** (it would also be possible to work horizontally instead of vertically).

Having thus obtained, in one way or another, portions of skin or covering **2**, provided with their stringers **3** and eventually with longitudinal bars **4**, and supposing that it is now desired to fix on the stringers and the longitudinal bars, angle plates **8**, it will be advantageous to have recourse to the methods above described, that is to say employ positioning means capable of supporting the respective elements to be assembled and of ensuring relative positions of said elements which are perfectly determined, while making it possible to carry out, or at least to start, the riveting.

In this case also it will be possible to act either on a skin-stringer unit which has been given the form it must have in the structure, as shown by Figs. 13 to 22, or on a unit of this kind supposed to be developed, every time such a development is possible (Fig. 24).

I will first suppose that the first of these solutions is adopted. The above mentioned means are arranged in such manner that they permit of engaging the skin-stringers unit against a kind of cradle of suitable shape which acts as pattern.

For instance, according to the embodiment shown by Figs. 13 to 22, and supposing that the process is applied to conical section **3**, (it being well understood that said method would apply as well to section II provided the curved section thereof in the longitudinal direction is taken into account for the forward fed of the cradle and the positioning means), the cradle is essentially constituted by a plurality of metallic sheets **37**, cut away in corresponding relation with the outer profile of the fuselage, and arranged in such manner as to be preferably at the level of the transverse frames and formers, these plates being carried by a support **38**.

As for the positioning means, they are constituted by curved members **39** adapted to come opposite the plates **37** of the cradle, these curved members including recesses at **40** for the passage of the stringers and of the longitudinal bars and being fitted with supports for receiving the angle plates and ensuring their mounting.

Advantageously, these curved members are mounted in a pivoting manner, being for instance movable, at one of their ends, about spindles **41** passing through supports **42** and adapted to be secured, at their other ends, at **43**, in similar supports. Finally these curved members may be provided, on the side of the ends opposed to those provided with pivoting axes, with a movable part **39**[1], pivoted at **44** and including recesses **40**[1] analogous to recesses **40**, this in order to ensure a perfect disengagement (Fig. 20). A device **74** (Fig. 1) permits of interconnecting, at the time of the mounting, parts **39** and **39**[1].

It will be readily understood that, when the whole is set in position, the skin or covering, together with its stringers, can be rigidly held between the metal sheets of the cradle, **37**, and the ridges of curved members **39** extending between recesses **40** or **40**[1]. It is then possible to effect, with a high accuracy, the positioning and assembly of the angle plates which will have previously been adapted to said supports of the curved members.

As for these supports they are advantageously arranged as follows:

They include lugs **45** adapted to penetrate into at least some of the holes **46** provided in the angle plates for the riveting thereof on the frames or formers (Figs. 16 and 17).

They must permit, once these angle plates are in position, of keeping them in said position, for instance by means of pivoting hooks **47** carried by the curved members and subjected to the action of springs **49**.

Figs. 18 and 19 illustrate analogous arrangements for fitting in position angle plates on longitudinal bars **4**, the whole being, preferably, carried by plates **75** displaceable with respect to curved members **39**.

Such arrangements permit, not only of obtaining a high accuracy in the assemblies, but also of having easy reach to the riveting apparatus and the riveting holes shown at **49** in Fig. 17.

Of course, the whole is arranged in such manner as to permit, once the riveting operation is finished, of disengaging the curved members. This result is obtained, for instance, in the following manner:

On the one hand, these curved members are adapted to undergo some transverse displacements, being for instance mounted with a certain play j (at least equal to the length of lugs **45**) in their supports **42** (Fig. 22), and tightening means **50** being provided for ensuring the positioning in assembly position (shown by Fig. 22) and for ensuring, after releasing, said lateral displacements.

And, on the other hand, concerning hooks **47**, they are mounted in such manner that they can, in position of rest, be retracted into holes such as **51** (Figs. 16 and 17), in such manner that they do not project from the face of the curved members located on the side of the angle plates.

Finally, the device above described may be completed by means for facilitating the obtainment, in the course of the mounting and the riveting, of a good pressure of application of the curved members on the skin or covering and the cradle. These means may consist in the provision, on each curved member (or on several curved members if they are conjugated) of an eccentric **52** combined with pin **43** which, for instance extends therethrough, this eccentric being operated through a hand control member **53** (Fig. 15*a*).

I have thus obtained a mounting system which permits of effecting the mounting of the angle

plates on one half of the covering or skin of section III (or any other section, for instance a portion of section II obtained on the device of Figs. 2 to 7) and which would also permit of making the other half, although it is also possible, for the latter, to work in connection with the mounting device intended for the assembly of the frames and formers and which will be hereinafter described with reference to Figs. 25 to 32.

In the case of developable sections of the fuselage, it would of course be possible to adapt the method above set forth to the case of the work being carried out in a plan.

As a matter of fact, if the whole obtained after assembly by means of the device of Figs. 13 to 22 is developed, I obtain a figure such as 23, in which the angle plates are disposed along arcs a, b, etc. Of course, it will be possible, in order to effect the assembly of the angle plates in a plane, to position them by means of curved bands **54** replacing said curved memebrs **39** and which may be provided with the same supports for the angle plates as them. The whole thus obtained can subsequently be very easily curved and transferred to the devices which will now be described. It should be noted that the arrangement of Fig. 24 might be combined with those of Figs. 8 to 12.

Concerning the assembly of the skin-stringers-angle plates units with the frames and formers, it is carried out by means such that these units are maintained, during the assembly, exactly in the final shape they are to occupy, always through positioning means analogous to those above described, the frames and formers being themselves maintained in the correct relative positions.

For this purpose, it is advantageous to have recourse to a device of the same kind as that of Figs. 13 to 22 but in which the curved members **39** are arranged in such manner as to be able to position the frames and formers, preferably after naving also positioned the angle plates with respect to the portion of the skin or covering placed in the cradle (Figs. 25 to 31).

It suffices, for this purpose, to provide, for said curved members, a possibility of transverse displacement j in supports **42**, of sufficient amplitude for taking into account, on the one hand, the stroke necessary for the disengagement of said lugs **43**, and, on the other hand, the space e occupied by the frame or former, after its introduction between the angle plates **8** and the curved members **39** (Fig. 30).

I therefore proceed to the mounting of the gussets, as above indicated. Then, once this has been done, the curved members are suitably disengaged and the frames or formers **6** are set in position (Figs. 29 to 31). I then exert, by means of the curved members and means such as eccentrics **52**, a new pressure toward cradle **37**, said curved members being for instance provided, from place to place, with projections **55** intended to act as abutments against the wings **56** of the frames or formers (Fig. 30).

At this time, everything is in position for permitting the riveting of the frames or formers on the angle plates, which can be done immediately, if there is sufficient room for this. Notches may eventually be provided for this purpose in the curved members for the passage of the tools.

It is also possible, as shown, to effect a temporary fixation, by vices **57** or any other means; each curved member **39** is then moved backward so as to permit the approach of the riveting tools (Fig. 31). In this position, it is still possible to maintain the pressure exerted on the skin, wedges **52** being interposed so as to make allowance for the conical shape of said skin.

I have thus riveted the frames or formers on one half (or in any kind a portion) of the whole constituted by the skin, the stringers and the angle plates. There remains to effect the assembly on the other half or part (for instance that established on the device of Figs. 13 to 22). For this purpose, this half is adapted above the elements **6** (Fig. 25) and it is very tightly held, eventually by making use of external curved members **59** (Figs. 25 and 27) which exert a pressure on the whole, which curved members can be removed after the squeezing operation.

Concerning the riveting of this second portion, it can be effected when the whole is in the horizontal position. But, on the other hand, this may be awkward. Therefore, it is sometimes interesting, according to another feature of the invention, to pivot the whole of the cradle and of the section of fuselage fixed thereto in such manner that said whole is disposed vertically, the workman or workmen being then able to work on a platform movable on the inside of the fuselage section.

For this purpose, the elements of cradle **37**, instead of being carried by the fixed frame **38** are carried by a movable support **60** which can be mounted in a pivoting manner about an axis **61**, the whole being operable by means of a cable **62** passing on a pulley **63** carried by a pillar **64** and ending on a winch **65**, with the provision, of course, of locking means **66**, **67**.

At **68** (Figs. 25 and 26) I have shown a shaft or pit in which can move the portions of longitudinal bars **4** which may eventually project from section III (which portions are intended to come to assemble with the covering or skin of section II, and on the inside thereof).

Concerning the mounting of the frames and formers **5**, **6** of this curved section II, it is possible either to proceed as above set forth, or of using floor **7** for positioning these elements **5**, **6**, which may previously have been assembled on this floor, for subsequently receiving the skin-stringers or skin-stringers-angle plates units. The whole can be carried out in line with a section III which has already been constructed, in such manner as to perform the assembly of section II on the extensions of the longitudinal bars **4** of section III.

I may further make use, for the assembly of the various sections, of connecting or coupling rims provided at the ends of said sections, according to the method set forth in the French patent application Ser. No. 441,519 above mentioned.

It should be noted that the assembly, in order to be absolutely accurate with the methods above set forth, calls for formers and frames **6**, **5** of highly accurate outline, same as the elements of cradle **37**.

For this purpose, it is advantageous to have recourse to arrangements already set forth in prior patent applications filed by me and according to which, starting for instance from two half-frames extending over 180° and of an outline well determined on a pattern (circular in the present case), and intending to assemble them together by means of fish-joints **69** (Figs. 32 and 33) in order to obtain a closed and perfectly circular frame or former, I proceed as follows: I effect the riveting of these joints on moulds or patterns **70**, **71**, of a shape corresponding exactly to that of the finished frame or former and

against which the halves of the element (frame or former) are fixed, by securing at 72, during the operation of riveting of the joint 69, which operation takes place through passage 73 and others provided in the pattern. The whole can be carried by a table 74 having expansible arms 75, 76, which can be adapted to a whole set of frames or formers of different diameters.

The chief advantages of the system according to the invention are the following:

The assemblies are effected with a high accuracy;

The structures can be caused to work under conditions of perfect homogeneity, which increases their resistance;

Quantity production is made easy.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

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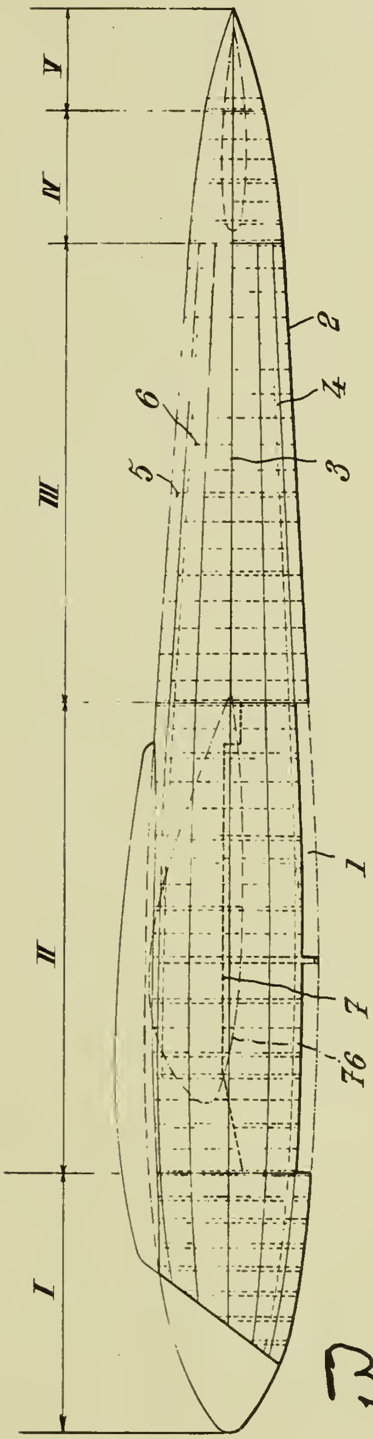
JULY 13, 1943.	CONSTRUCTION OF FUSELAGES	**288,683**
BY A. P. C.	Filed Aug. 5, 1939	20 Sheets-Sheet 1

Fig. 1.



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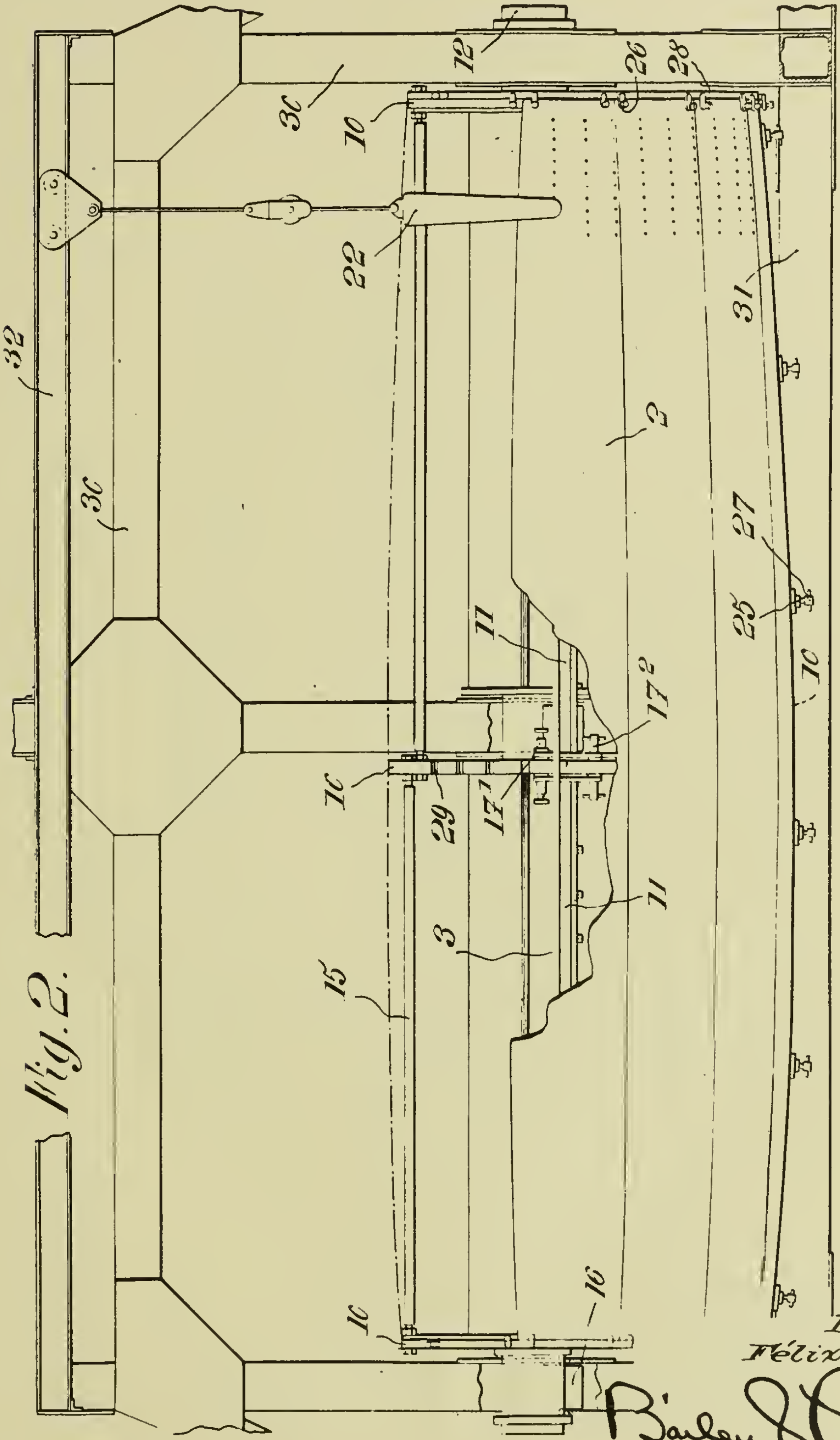

Fig. 2.

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Fig. 3

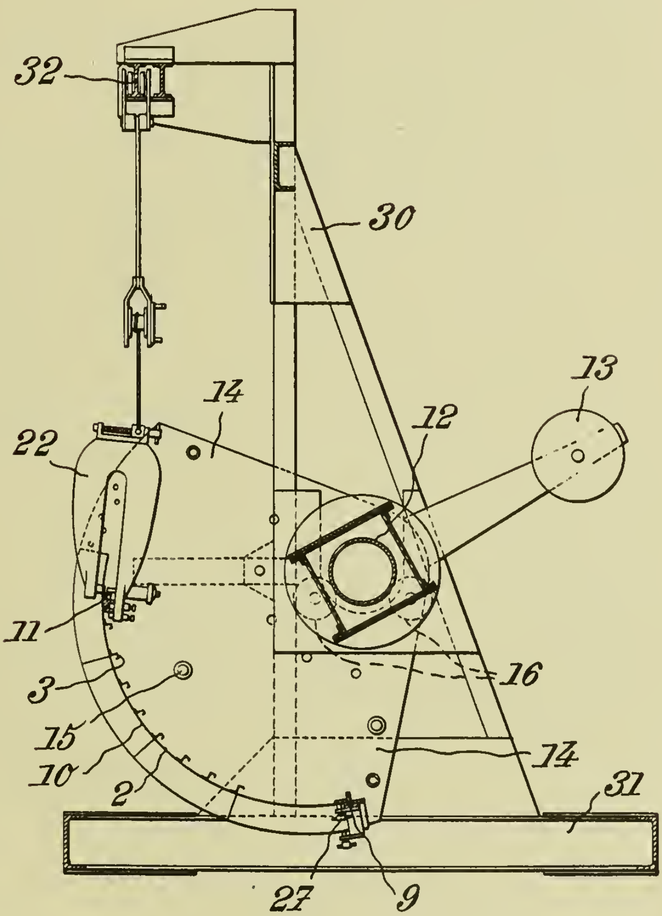

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Fig.5.

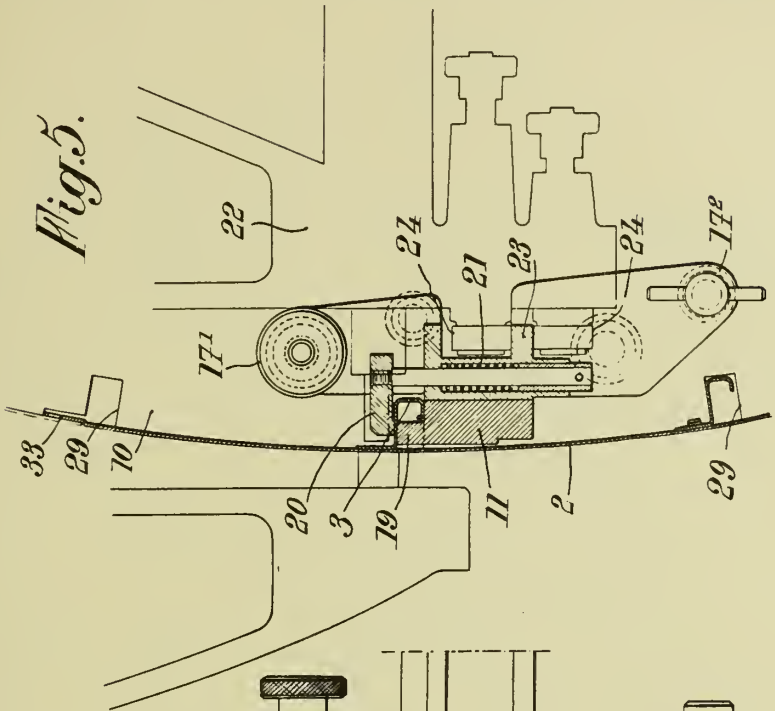

Fig.4.

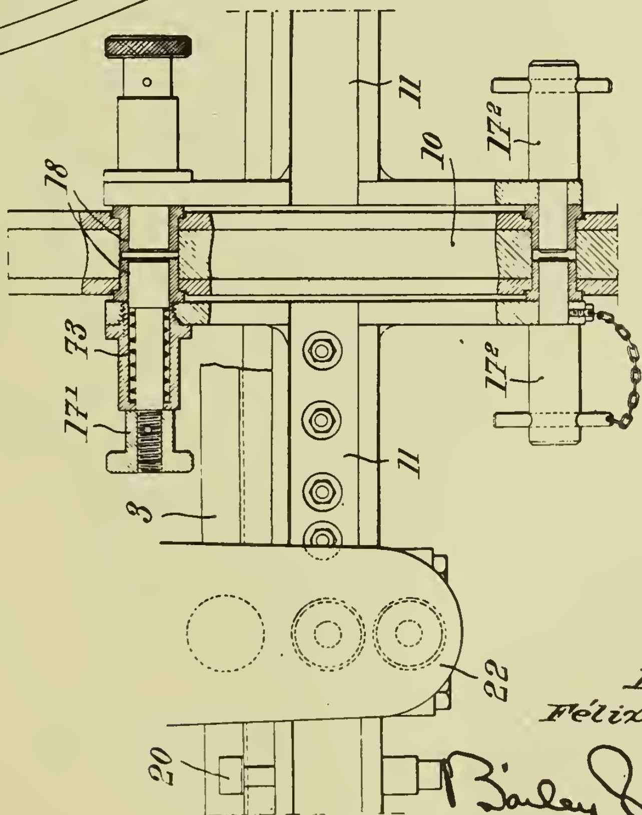

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Fig. 6.

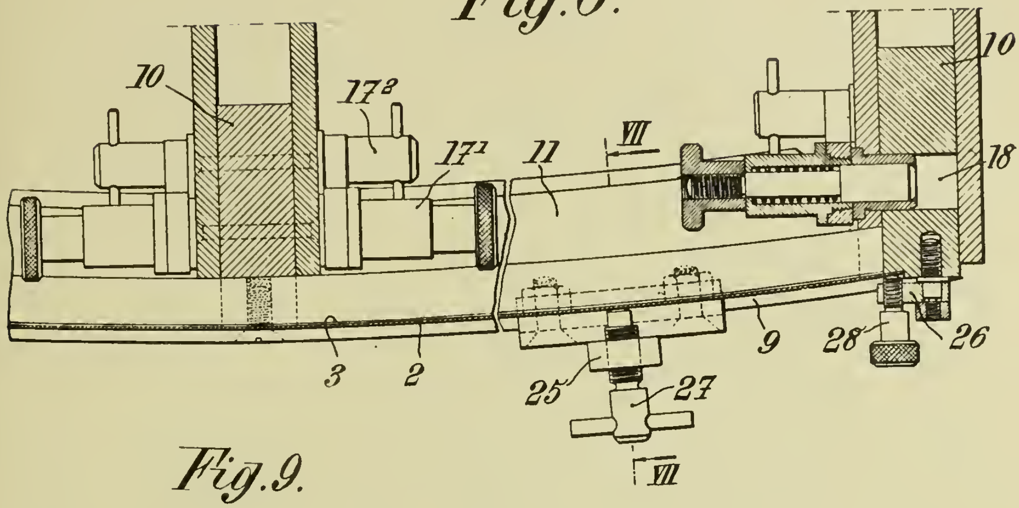
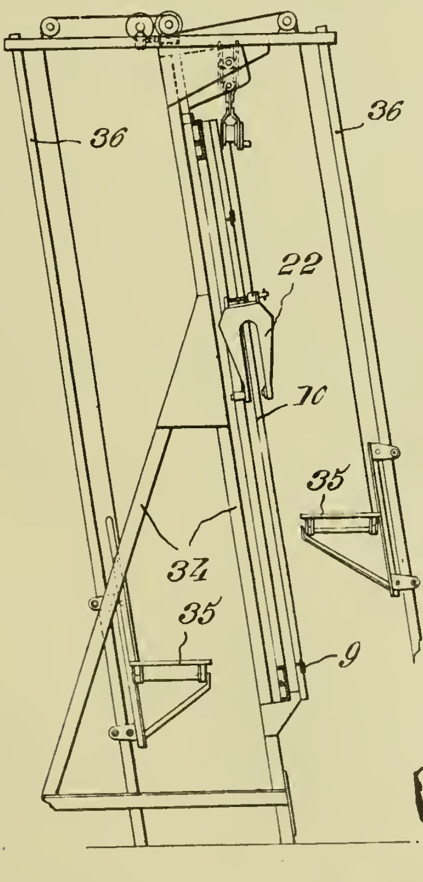


Fig. 9.



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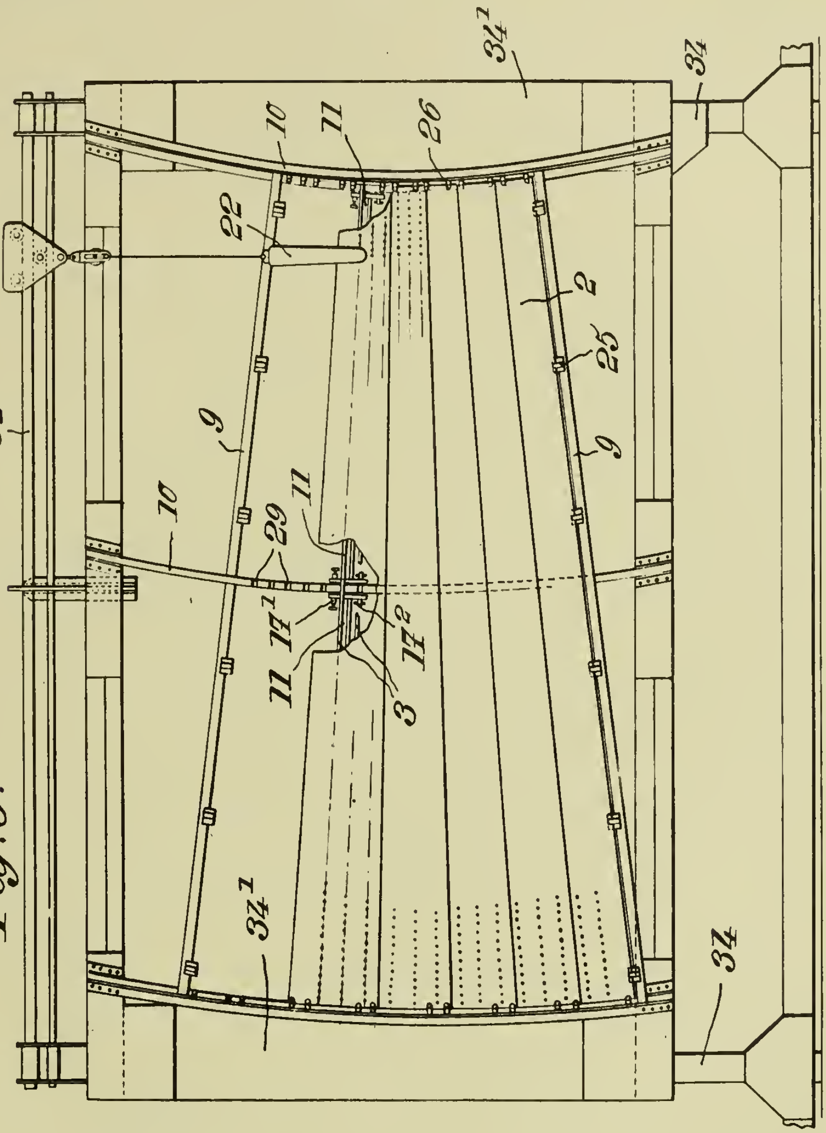

Fig. 8.

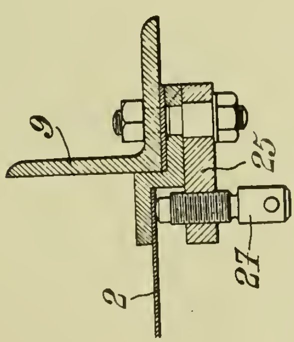

Fig. 7.

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Fig.10.

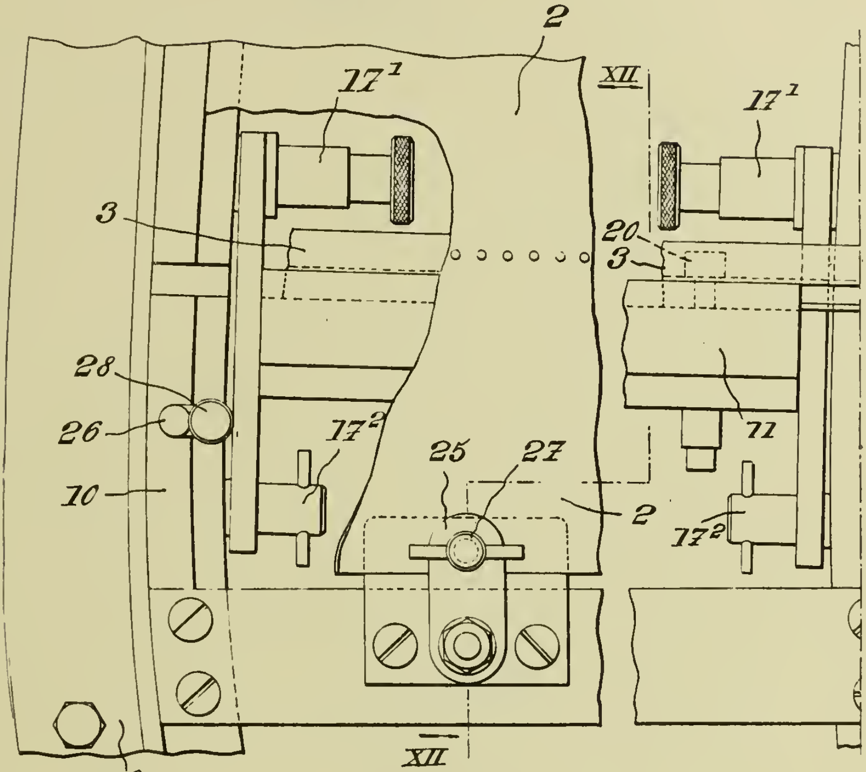
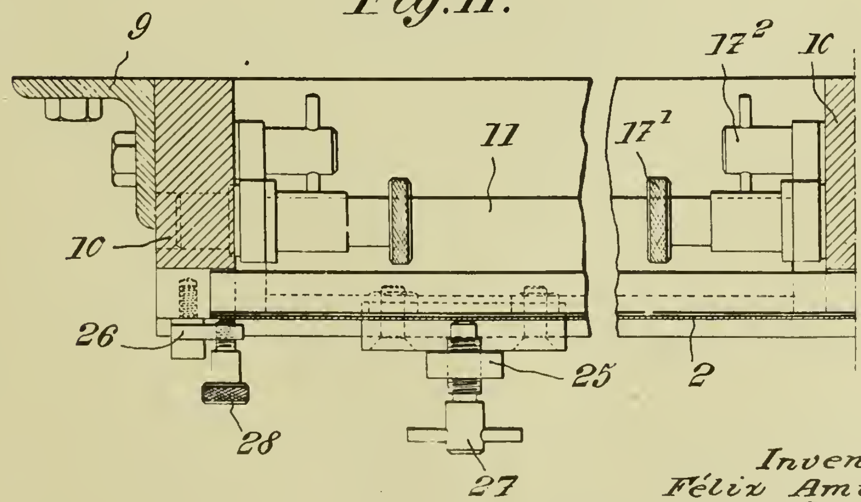


Fig.11.



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CONSTRUCTION OF FUSELAGES
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Fig. 12.

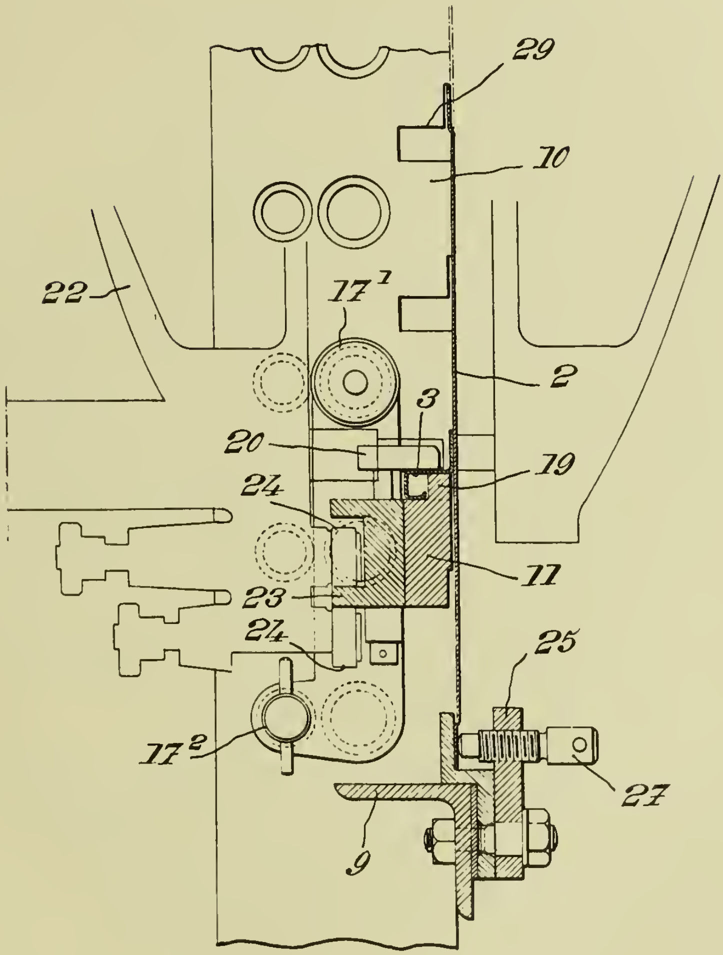

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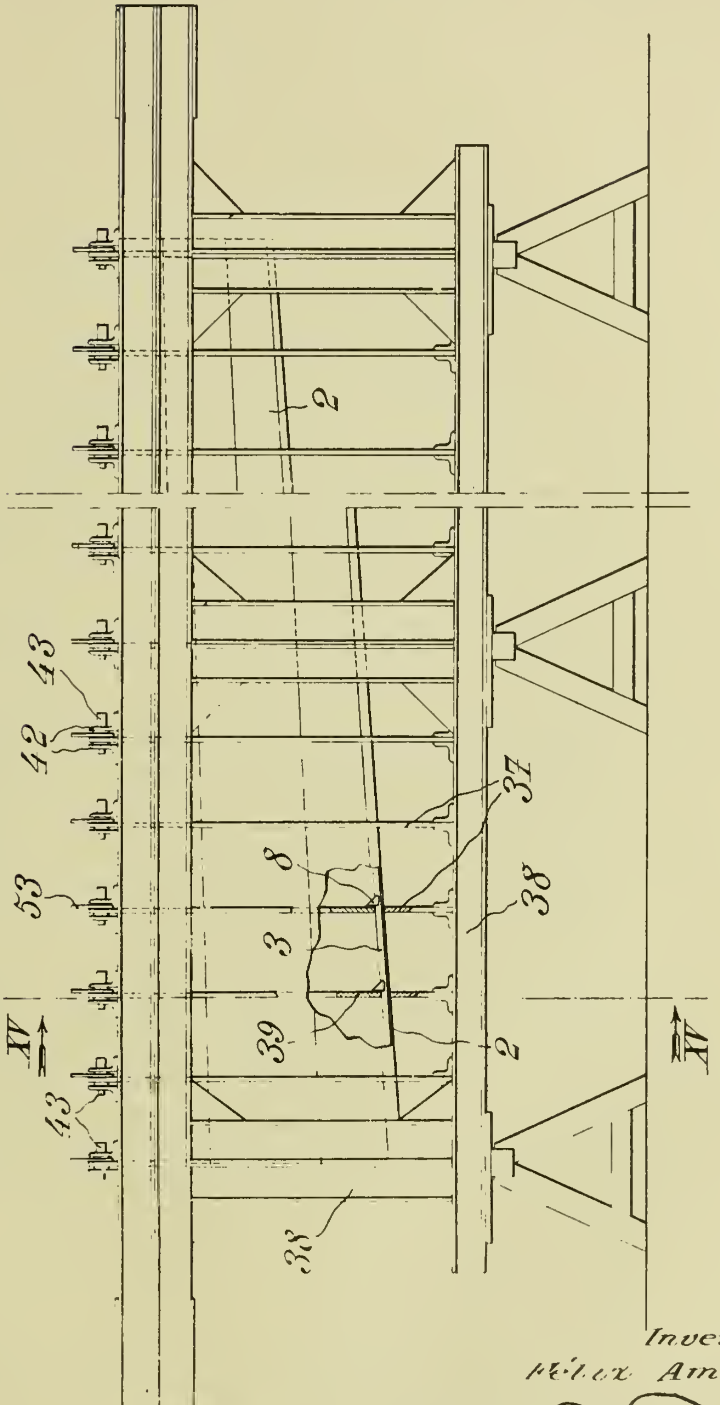
Fig. 13



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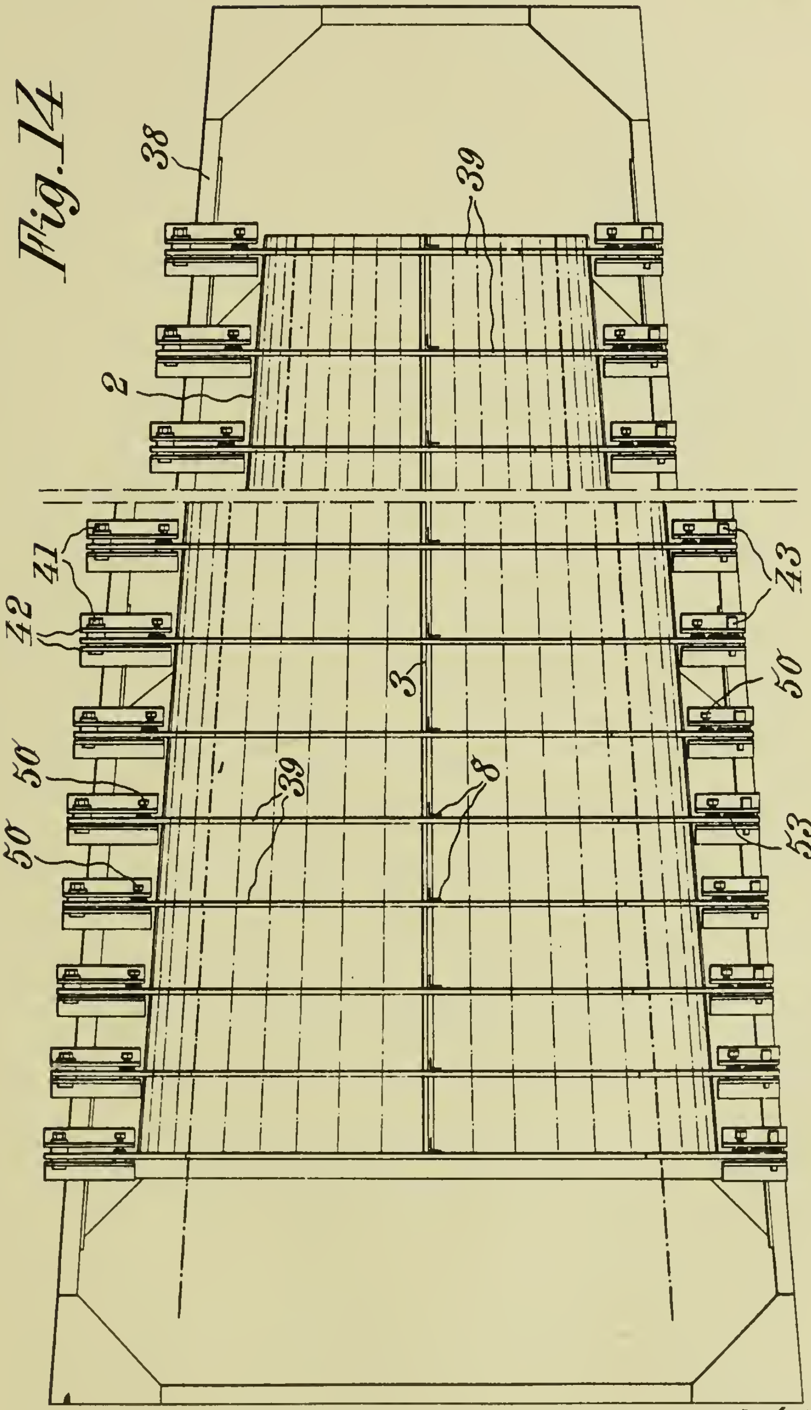

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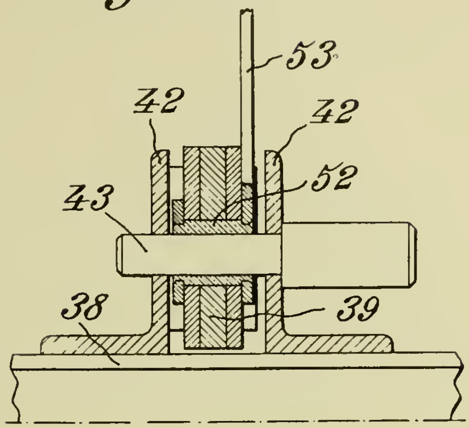
Fig.15a



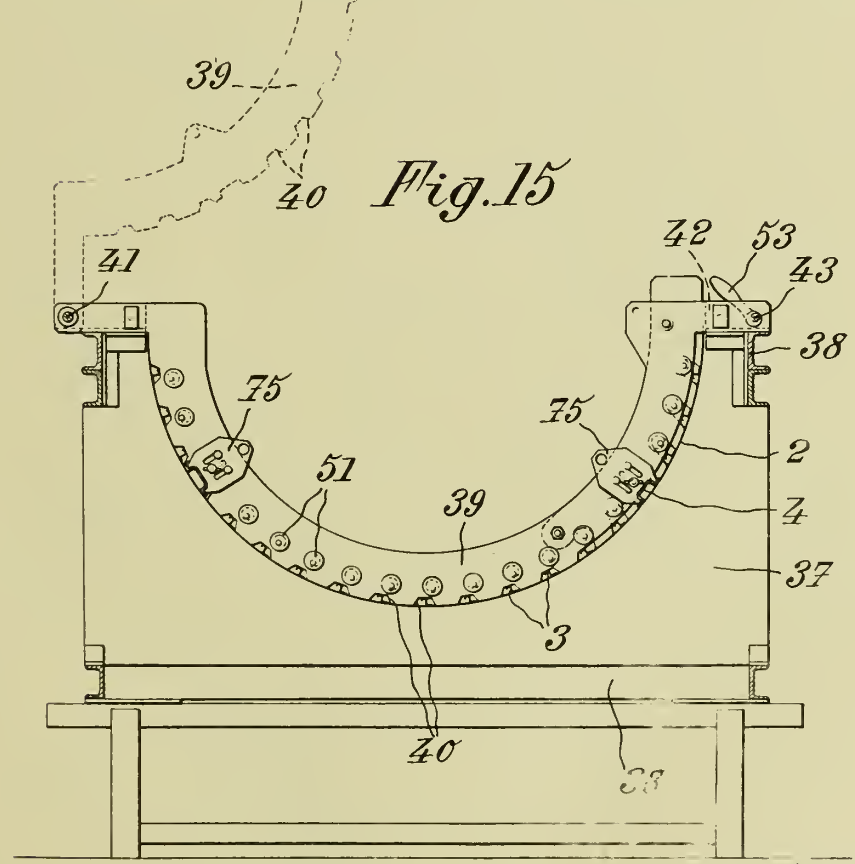


Fig.15

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Fig.16

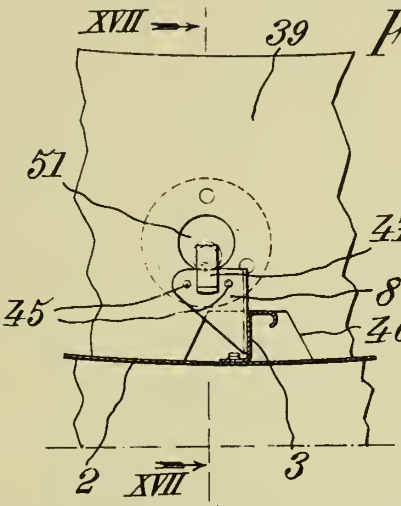

Fig.17

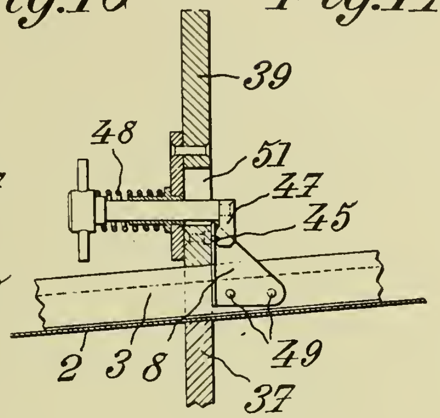

Fig.18

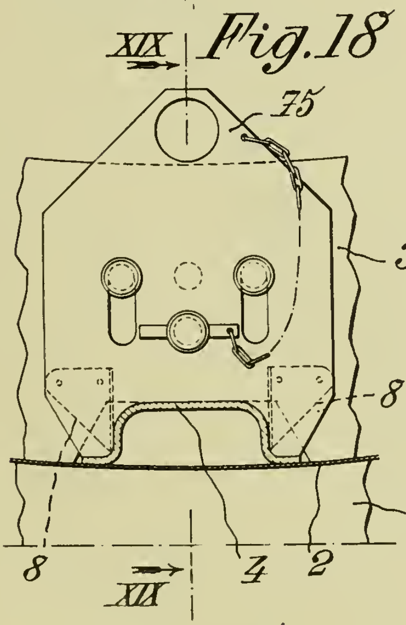

Fig.19

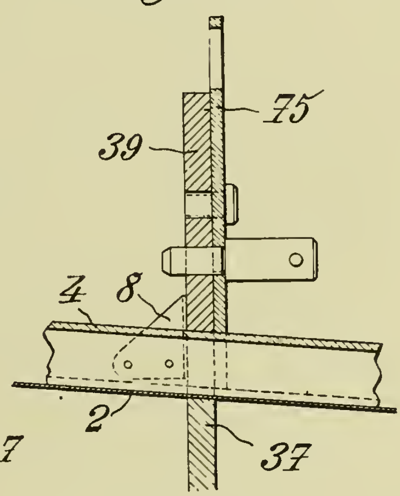

Fig.22

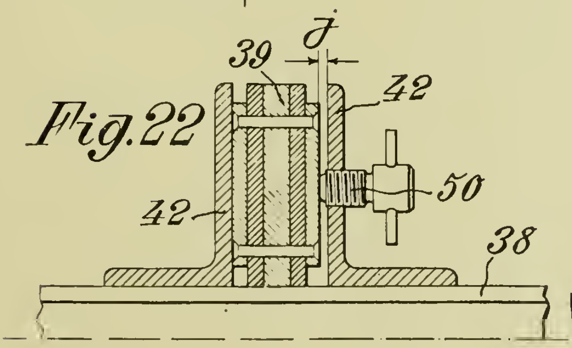

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Fig. 20. Fig. 21.

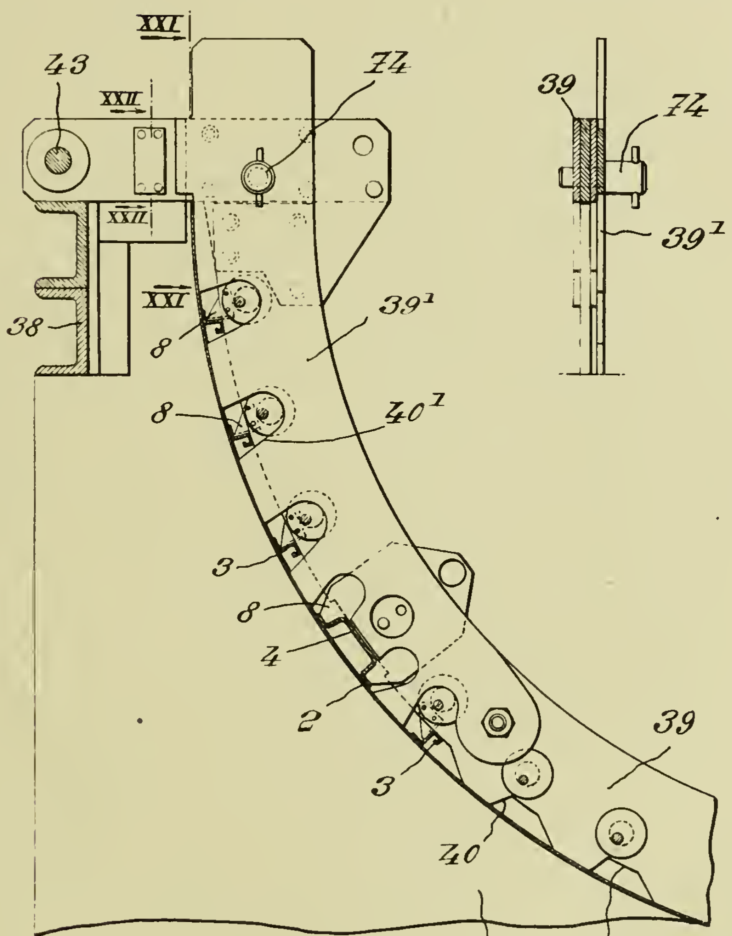

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Fig. 23.

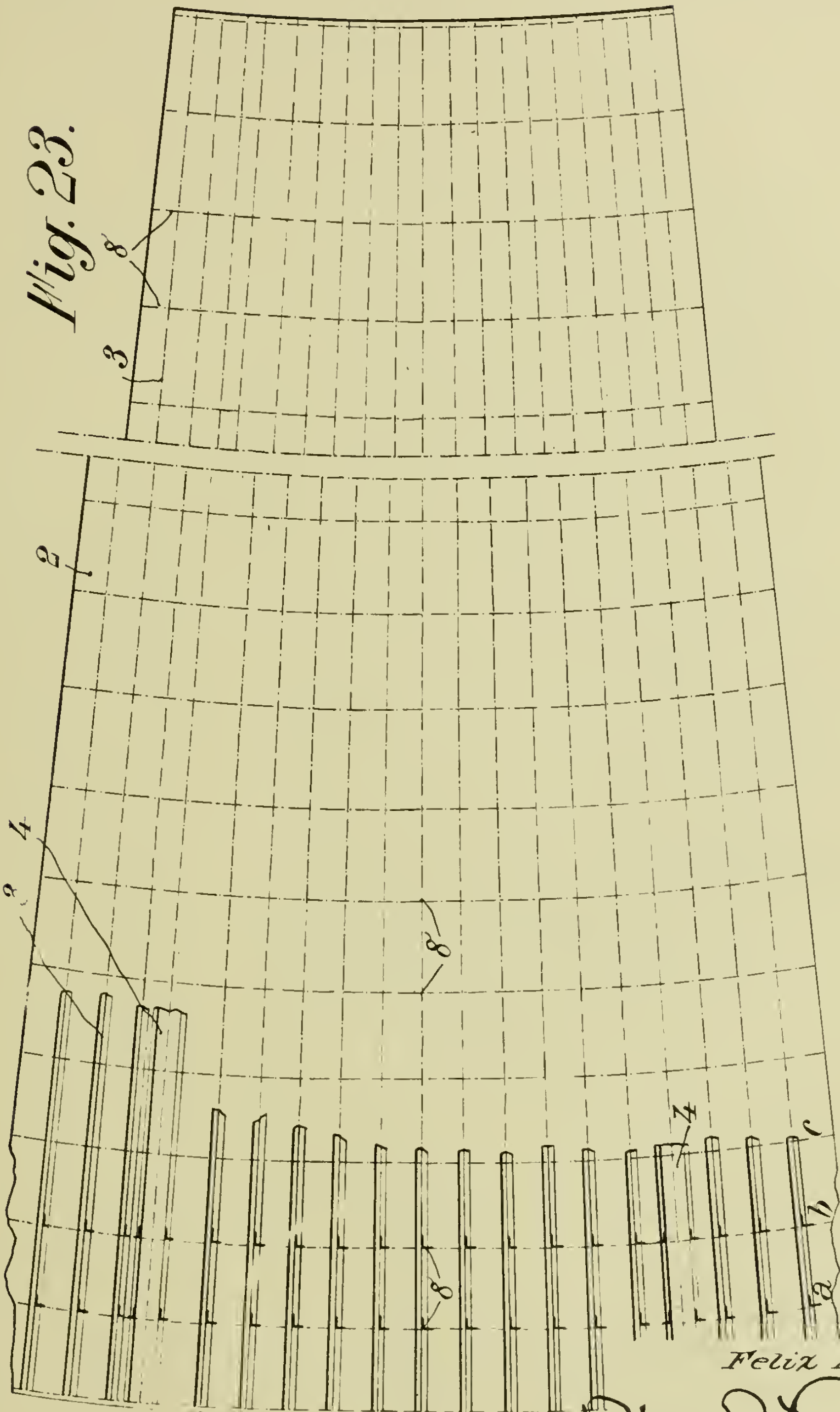

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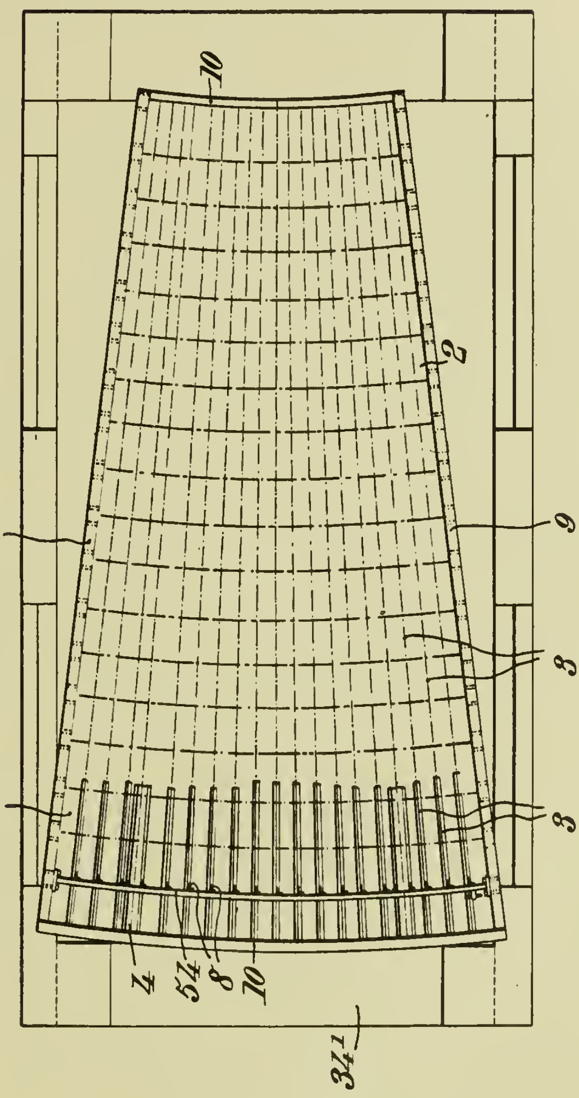
Fig. 24.



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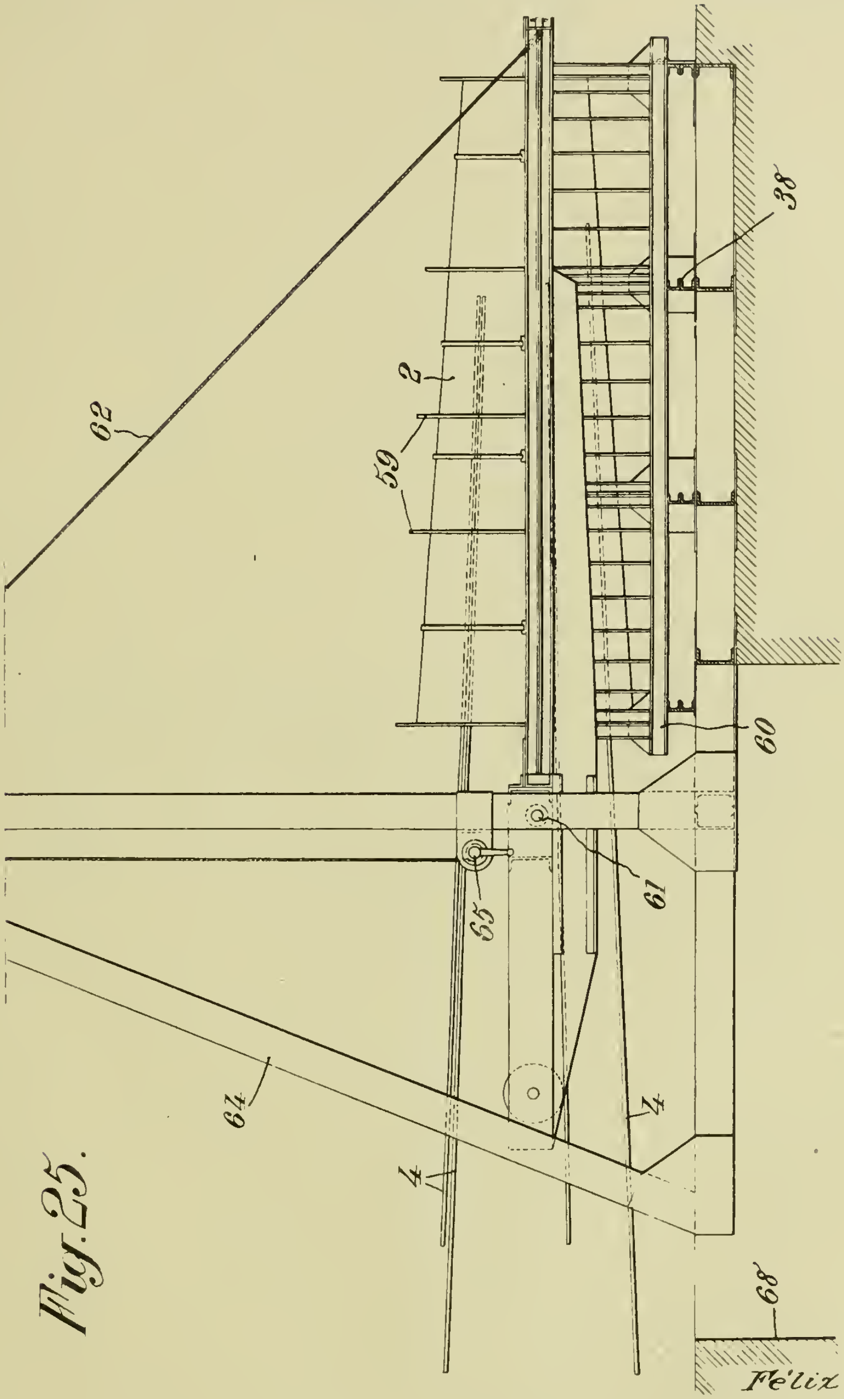

Fig. 25.

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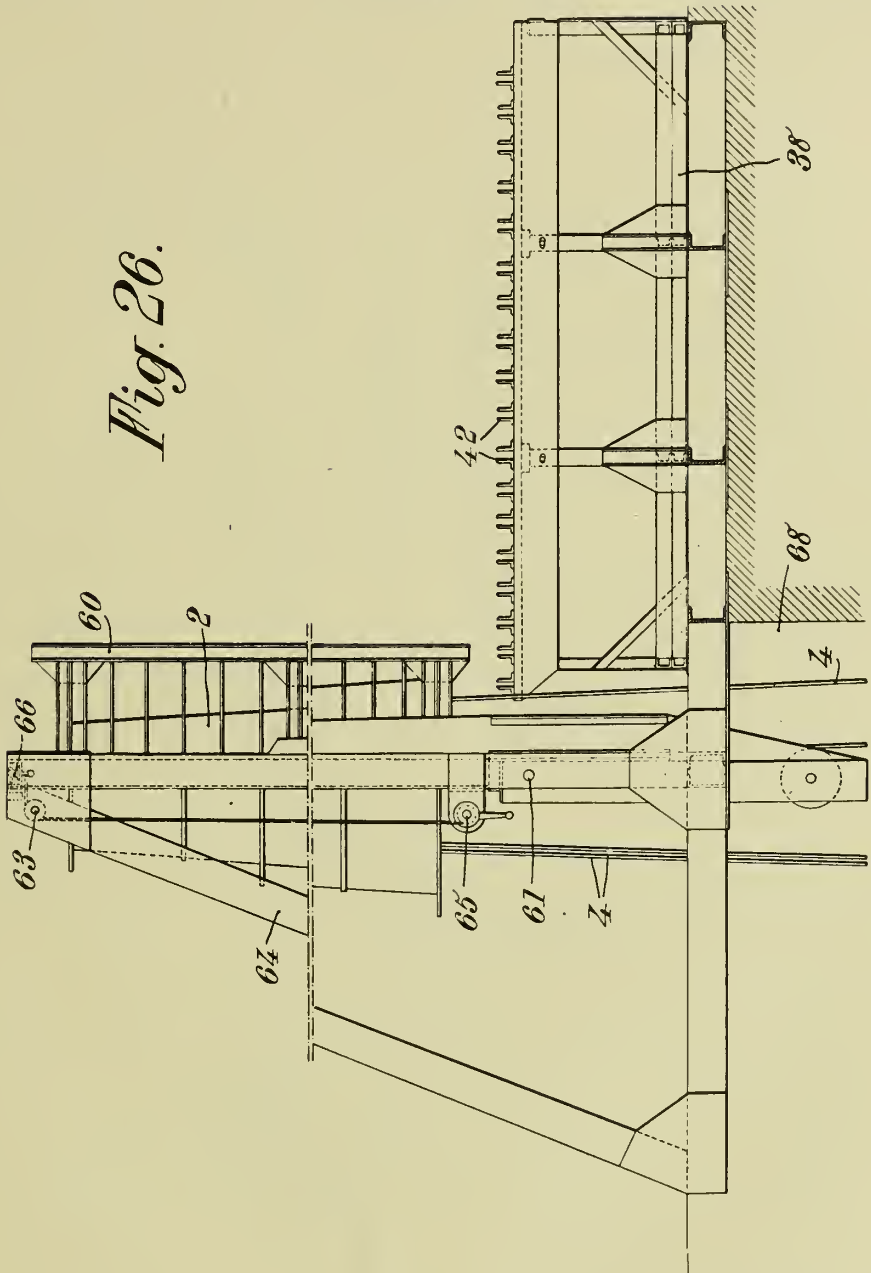
Fig. 26.



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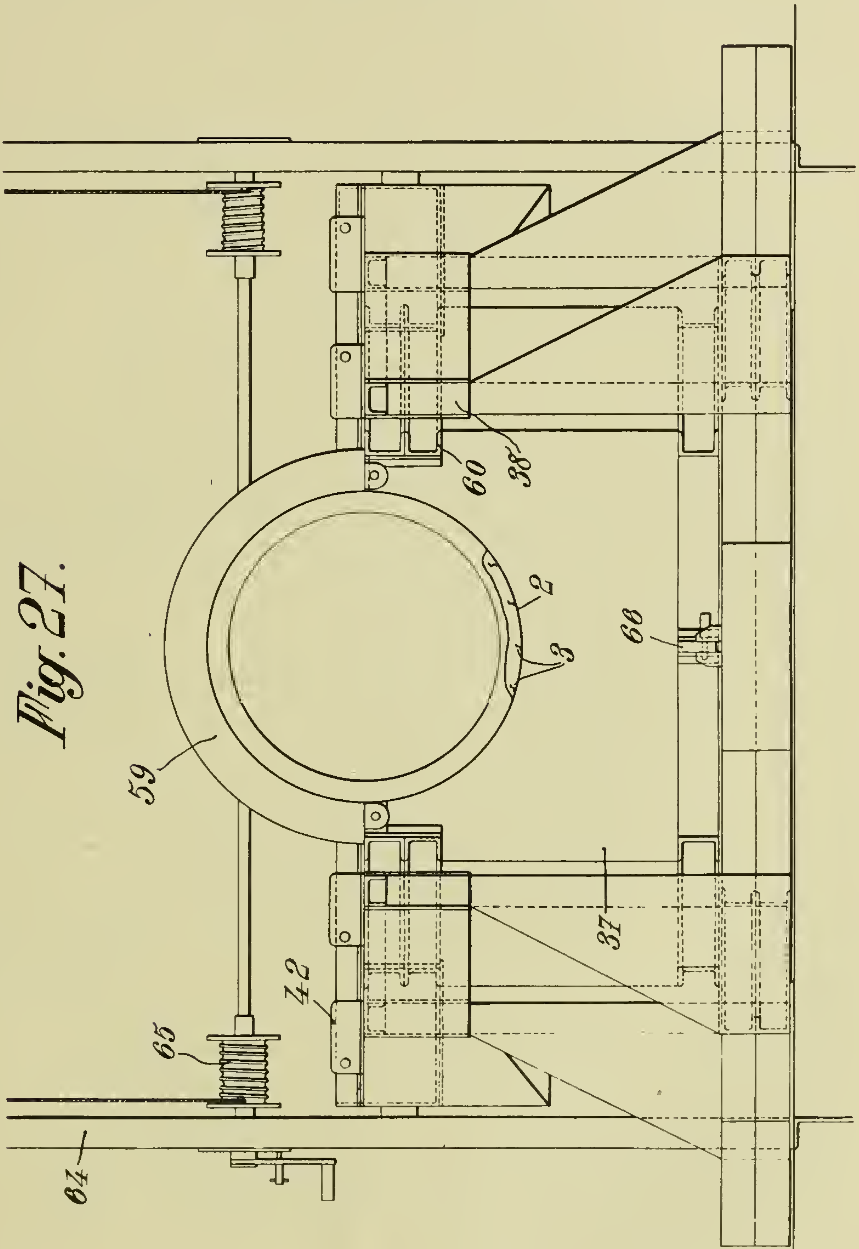

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Fig. 28.

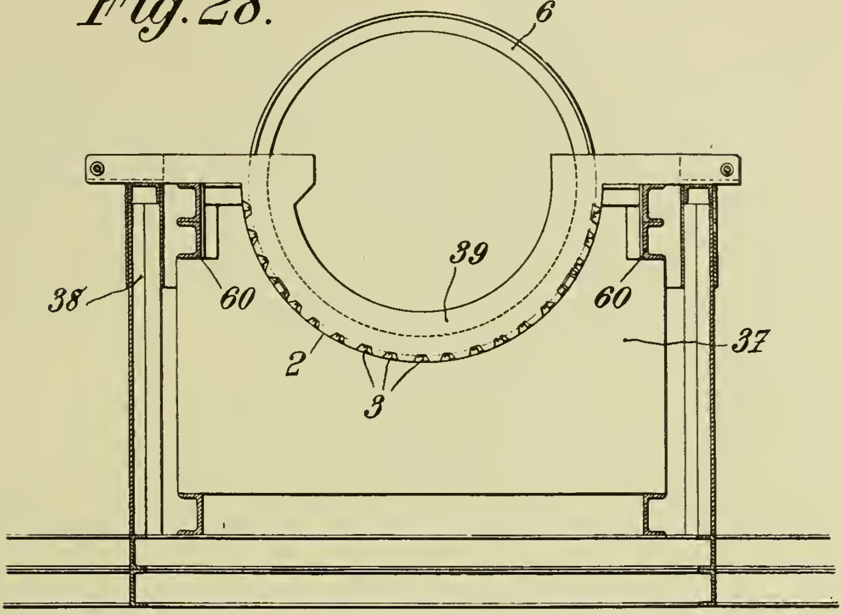

Fig. 29.

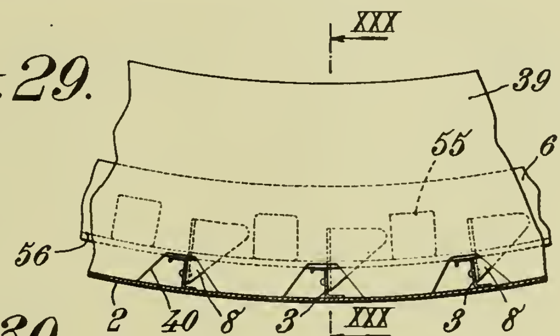

Fig. 30.

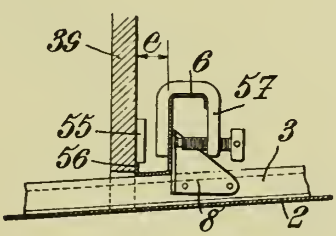

Fig. 31.

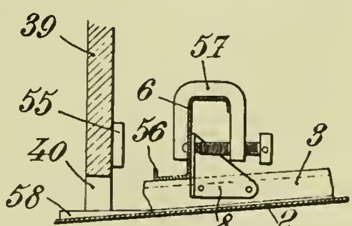

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Fig. 32

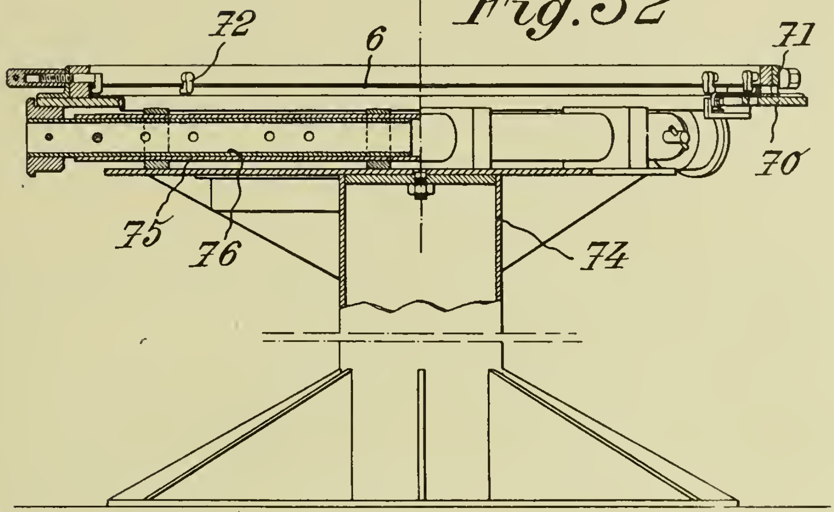
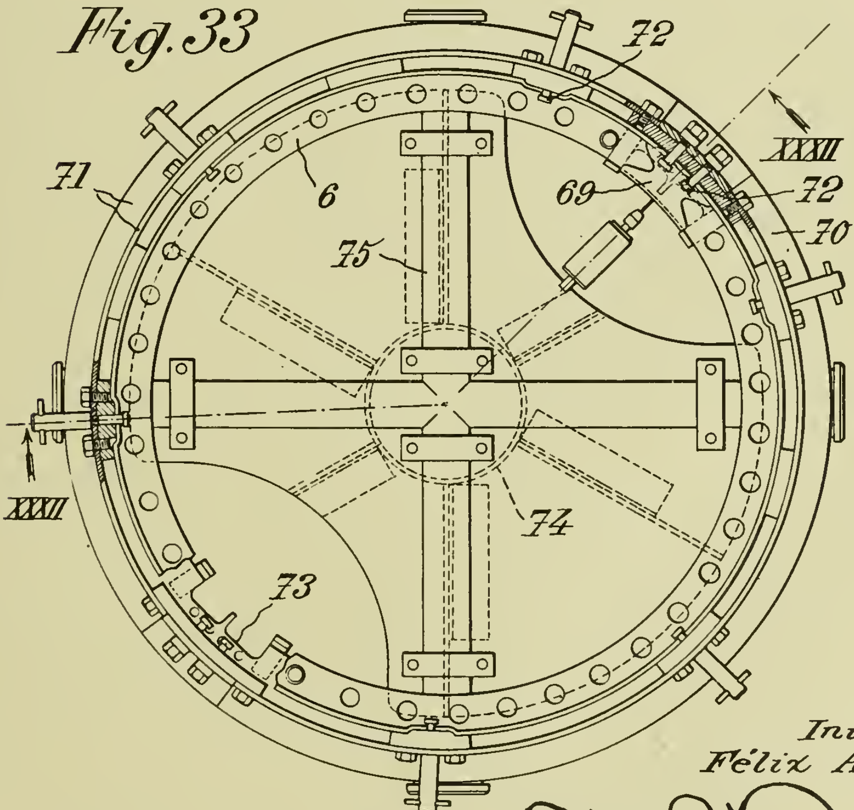


Fig. 33



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Published July 13, 1943 Serial No. 290,026

ALIEN PROPERTY CUSTODIAN

DEVICE FOR SUPPORTING ARTICLES IN GALVANIC BATHS AND THE LIKE

Robert Weiner, Francfort-on-Main, Germany; vested in the Alien Property Custodian

Application filed August 14, 1939

The present invention relates to the suspension in galvanic baths and the like by means of suction of objects which have no hooks, eyes or similar attachments.

The known devices of this kind have various disadvantages of which one, for example, consists in that to support objects to be suspended in addition to the suction additional mechanical means must be provided. This renders the apparatus complicated and expensive. A further disadvantage is that vibration, such as impacts against the container of the bath, generally react very unfavourably on the objects to be galvanized which are often very sensitive. Finally, it has been found to be a defect of the known apparatus that it is not possible rapidly to mount in position the objects to be galvanized.

Now I have found that the above mentioned defects and disadvantages can very simply be avoided by providing, for the direct attachment of the objects to the carrier, suction cups of elastic materials which conveniently are also provided with conducting parts for the supply and withdrawal of the electric current.

The apparatus according to my invention has also the advantage that, in particular, objects which have no hooks, eyes or the like can be suspended in the bath very rapidly without trouble and with certainty. Thus, for example, shields, medals or the like can very rapidly and with certainty be applied to their carrier. The use of the previous widely customary frame for holding the objects to be galvanized can be completely eliminated by using the apparatus according to my invention. Holding frames have, apart from their complications in use, the further disadvantage that the frame, together with the object, cannot be moved through the liquid of the bath because then the contacts for the electrical current supply are affected. This disadvantage has a particularly unfavourable effect when, for example, in processes for chromium plating, it is absolutely necessary to have very powerful and good contacts.

The suction cups to be used according to my invention can consist of india-rubber or the like. In certain cases a suction conduit can be connected to the suction member so that it is possible to alter at will the pressure prevailing in the suction space.

The suction members can consist wholly or partly of metallized india-rubber so that in some cases the provision of special electrical connections is unnecessary.

It is convenient so to connect the members carrying the electric current with the supporting parts of the apparatus that in practical operation they are completely protected from undesired influences, for example the liquid of the galvanic bath. Preferably a screw is used as the member for fastening the suction cup to a member of the container for the bath, which screw projects into or traverses the wall of the suction cup in the latter case has, for example, a shoulder or the like by means of which the screw abuts against the inner surface of the suction cup. Preferably, in order to secure the screw bolt and in some cases to adjust it there is provided a nut which is conveniently so disposed outside the suction cup that it can be adjusted by hand.

A particularly simple and convenient constructional form of the subject of my invention is obtained when the above mentioned attachment screw is constructed as a conductor for the electrical current which is to be supplied to the object to be galvanized.

For transferring the electric current to the object to be galvanized there is conveniently provided a contact spring which is preferably disposed in the cavity of the suction cup. This arrangement has, for example, the advantage that the contact spring is fully protected from the influence of the gelvanic bath when the suction cup is pressed on, i. e. when in practical operation.

In addition to the contact spring, there is conveniently also provided an expansion spring which seeks to bring the contact spring into abutment with the object to be galvanized or its rear side. When an expansion spring is so used, the contact spring is bowed and so arranged that it encircles the expansion spring in U-form. The one end of the contact spring is then connected in a conducting manner with the head portion of the attachment screw which passes centrally through the wall of the cup, whilst the other end of the contact spring carries the contact plate which is to abut against the object to be galvanized. At the rear side of the suction cup is preferably provided a projection which is conveniently of dish form, the cavities in the dish and the suction cup facing away from one another. The projection of dish form has, for instance, the advantage that it permits a secure positioning of the whole suspension device on an object, ledge or the like, in particular when the projection is likewise constructed as a suction cup.

An arrangement is also to be recommended in

which the projection and the suction cup are formed as a unit, for example of india-rubber or the like. In some cases there can be provided between the projection and the suction cup a thin portion of such form that the suction cup has a certain freedom of movement relatively to the projection.

When providing a projection on the suction cup, the member for attaching the whole suspension device is conveniently located in the central axis of the device. In some cases the supporting bolt, for example a screw bolt, is of hollow construction and provided at its end remote from the suction cup with a connecting piece by means of which it can be connected to a pressure conduit or the like. The other end of the screw bolt then conveniently opens immediately into the cavity of the suction cup so that the pressure or suction produced in the cup cavity on pressing the cup on to the object to be galvanized can be varied if necessary. It is also then possible by increasing the pressure in the connected conduit to facilitate detachment of the object from the cup. The suspension device and, in particular, the parts of it which come in contact with the liquid of the galvanic bath are preferably constructed of a material practically insensitive to the influence of the bath, for example acid-resisting india-rubber; in some cases the particularly endangered parts may be provided with a protective coating, for example of varnish or the like.

As has also been found, the utility of the suspension device can be increased by using several suspension devices, for example in a row adjoining one another on one ledge. An example of construction of the subject of my invention is shown diagrammatically and in section in the accompanying drawing.

1 denotes the suction cup consisting, for example, of ordinary soft rubber or other elastic natural or synthetic material which is provided on the side remote from its cavity with a rearwardly projecting portion **2**, which adjoins a further portion **3** having the form of a bell or dish, the diameter of which is greater than the diameter of the throat **2** but smaller than the diameter of the suction cup **1**. The suction cup **1**, throat **2** and dish shaped portion **3**, which can likewise have the form of a suction cup, consist of a single piece, all the parts of which are conveniently in the form of bodies of revolution. Coaxially with the central axis of these bodies of revolution is provided a screw spindle **4** having, at the end terminating in the cavity **5** of the suction cup **1**, a collar or shoulder **6**, the rear annular surface of which abuts against the inner face of the suction cup. On the screw spindle **4** is also arranged an adjustable nut **7**, which is located within the cavity **8** of the dish shaped portion **3**.

The screw spindle **4** engages in a frame **9**, for example of ledge form, and thereby gives the suspension device the necessary support and the correct position.

In the cavity **5** of the suction cup **1** is provided a contact spring **10** connected at one end with the shoulder **6** and at the other end to a contact plate **11**. Between the front face of the shoulder **6** and the opposing surface of the contact plate **11** is arranged a helical spring **12**, consisting for example of steel, which seeks to distance the contact plate **11** from the shoulder **6** and thereby brings the plate into firm abutment with the object **13** to be galvanized, for example an ornamental shield.

The screw **4** may be made of brass, the contact spring **10** of copper plate, and the suction cup, together with the parts formed in one piece with it, of rubber or the like.

To the screw **4** is attached in a manner not further described the connecting lead for the supply of electrical current to the object to be galvanized.

The suspension of the object to be galvanized and the attachment of the electrical contact is effected in a simple manner by pressing the suction cup on to the rear face of the shield or the like to be galvanized. In place of the contact device shown in the drawings, there can obviously also be employed a device constructed as a bell push contact.

ROBERT WEINER.

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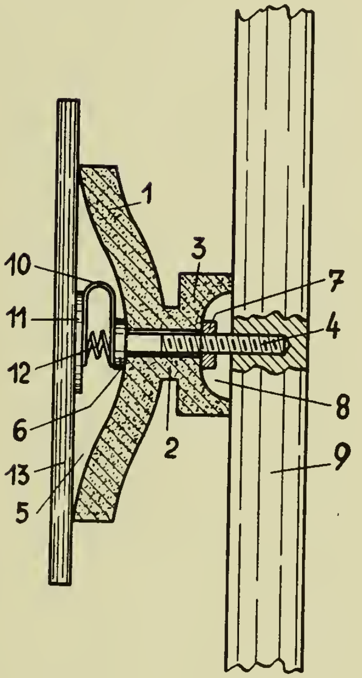

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF COMPACT JUNCTIONS OF LIGHT METALS AND LIGHT METAL ALLOYS WITH HEAVY METALS AND HEAVY METAL ALLOYS

Hans Bernstorff, Frankfurt A/M., and Albert Allendörfer, Bad Homburg V. D. H., Germany; vested in the Alien Property Custodian

No Drawing. Application filed August 30, 1939

Our invention relates to the manufacture of compact junctions of light metals or their alloys and objects made therefrom with heavy metals or their alloys and objects made therefrom whereby these compact junctions are made without any welding or soldering process.

According to our invention beryllium, aluminium, magnesium and their alloys may be used as light metals, whereas copper, lead, tin, gold, silver, zinc, iron, nickel, chrom tungsten, molybdenum, titanium, thorium and their alloys may be used as heavy metals.

Our invention may be employed over a very wide range, so for instance, for the junction of tubes, pieces of tubes, cylinders, sheets, rods, wires and so on, made from light metals, with the same or otherwise formed objects, which are made from heavy metals, or vice versa. According to our invention, for instance, tubes made from heavy metals may be manufactured with intermediate pieces from light metals, or tubes may be formed which consist out of alternate nearly equal parts of heavy metals and light metals. Furthermore, it is possible to join sheets of heavy metals with those made from light metals. Objects, such as for instance, sheets of light metal, may be coated with heavy metals or may be bordered with them. A further object of our invention consists in manufacturing, for instance, a cylinder from soft metal which is enclosed in a cylinder of heavy metal in such a manner that the outer wall of the internal cylinder and the inside wall of the external cylinder are in contact with each other. Sheets of light metals which are bordered with ledges of heavy metals or the like may be used, for instance, for the manufacture of cases or the like.

According to our invention the junction of light metals and their alloys with heavy metals and their alloys will be carried out as follows: The junction points are brought into contact with each other and then heated to temperatures lying below the melting point of the lowest melting constituent. During the heat treatment the objects to be joined are subjected to sintering by means of pressure. These very simple proceedings result in excellent junctions between light metals and heavy metals according to the fact that a diffusion process takes place at the junction points of the metals. We have found that the penetration of one metal into the other or the alternate diffusion between the metals develops quicker with higher temperatures. Therefore it has been proved advantageous to use temperatures which are near the melting point of the lowest melting constituent. Nevertheless, lower temperatures will yield also to satisfactory junctions. In cases which require an absolute stability of form and constancy of volume we have found it advantageous to use temperatures considerably below the melting temperature of the lowest melting constituent. It is necessary to extend the duration of treatment in such cases.

An important feature of our invention is the effect of pressure during the heat treatment. The use of pressure involves a better, more uniform and remarkably quicker diffusion. Of course the rate of diffusion depends also on the constants of material.

The duration of heat treatment depends on the consistency of the metals to be joined with each other and on the other conditions of work, such as height of temperature, height of pressure and so on. Usually a heat treatment of about one to five hours is sufficient. In some cases 10 minutes or about half an hour will suffice.

According to our invention higher pressures, for instance, 50 to 100 kgrs/qcm or more may also be used. In many cases lower, even considerably lower pressure will be sufficient. A low pressure is, for instance, well suited of soft metals, such as copper or lead, are to be treated.

The pressure may be produced after well known methods, for instance, by compression. Sometimes the use of compression will be superfluous, for instance, if one of the metal components, such as the border part or the outer casing will be able to exert a pressure on the included metal part during the heat treatment on account of its thermal properties. For instance, a light metal sheet, made from beryllium, which is to be joined tightly with a border of a heavy metal, such as copper, may be worked in such a manner that the copper border is shrinked on. Furthermore, the metals may be joined with each other in such a manner that the desired pressure at the junction area originates from the irregular dilatation of the metals. According to our invention double cylinders, junctions between tube connecting pieces and so on may be manufactured in this manner.

If necessary the metal areas which are to be joined with each other may be subjected to a precleaning. Very good junctions may be obtained, however, if the special cleaning processes such as descaling, treatment with chemicals and so on are not employed.

Our invention may be illustrated with the following example of a junction between copper and beryllium: A temperature of 850° C. and a

pressure of, for instance, 70 to 100 kgrs/qcm during a time of about one hour will result in a diffusion layer of about 1 mm thickness which proves to be an intimate and solid junction between the objects to be joined with each other.

Our invention is of special advantage insofar as a junction of light metal parts with heavy metal parts or objects therefrom may be carried out with absolute consistency of volume and stability of form. Furthermore, our invention is especially suited for metals or metal alloys which may be soldered or welded only with difficulty, such as, for instance, beryllium and certain beryllium alloys.

An important field for the employment of the process according to our invention is, for instance, the manufacture of windows for X-ray emanation, tubes or other emanation tubes which serve for the formation of electromagnetic or corpuscular rays (electron microscope, radio active, i. e. atomic conversion phenomena). Our invention is especially suited for these purposes giving the possibility to border windows from beryllium which is not weldable or solderable per se with a ring of a suitable heavy metal, for instance, copper. Those windows may then be inserted vacuum tight after a known method into vacuum apparatus of all kinds, for instance, by welding or soldering.

HANS BERNSTORFF.
ALBERT ALLENDÖRFER.

Published July 13, 1943

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR CHEMICAL REACTIONS IN MELTS

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No Drawing. Application filed August 30, 1939

Object of our invention is a process for carrying out chemical reactions consisting in introducing gaseous or vaporous reactants into a melt. This melt serves as a heat carrier, acting itself catalytically or containing catalysts. The introduction of the reactants into the melt is carried through in such a manner that the gasesor vapors effect a permanent, thorough and uniform intermixture of the melt as well as of the introduced substances. The temperature in the melt is well adjusted according to the conditions of the reaction. By these means it is possible to maintain the melt during the whole process at the desired temperature which proves to be of special advantage for the reaction. At the same time it is possible to bring the reactants into intimate contact with each other and also with the melt and the catalysts. In consequence of the considerable capacity of heat of the salt melt with respect to the comparatively insignificant little parts of the reaction participants which are present in the melt, all possible chemical reactions may be carried through isothermically, even if the reactions per se are qualified by marked absorption or evolution of heat. As a consequence of the permanent intermixture of the melt, evolved by the gaseous or vaporous reactants, new heat transfer as well as catalytically effective contact surfaces between the melt and the reactants are constantly formed.

The introduction of the gaseous and/or vaporous reactants into the melt may be carried out with nozzles or the like. If necessary, the agitating effect may be enhanced by the introduction of a gaseous initial substance in excess or even in great excess. According to our invention it is also possible to introduce inert gases or vapors, as for instance, carbonic acid, water vapor and the like, besides the other gaseous or vaporous reactants, in order to increase the agitation in the melt.

Our invention is especially suitable for the carrying through of various reactions, such as for instance, the chemical addition of water, splitting off water, hydrogenation, dehrydrogenation, oxidation, dissociation, polymerisation and the like. At the same time organic compounds of different character, for example hydrocarbons, compounds containing oxygen, such as alcohols, aldehydes, carboxylic acids, ketones, phenols, amines and the like may be introduced into the melt and brought to conversion therein. Furthermore, reactions of an anorganic nature, for instance, the manufacture of hydrocyanic acid ex carbon monoxide and ammonia, or the manufacture of SO_3 and the like may be carried out according to our invention.

Thorough investigations have shown that a considerable amount of substances may be used for the manufacture of the aforementioned melts, such as for instance, nitrates, nitrites, chromates, acetates, chlorides, cyanides, bromides, furthermore oxides, hydroxides, sulfates etc. of alkali metals, earth alkali metals, earth metals, rare earths, such as cerit chloride and so on. Furthermore carbonates, phosphates, borates, silicates, such as glasses or silica, and the like, cyanates, urea or other organic substances such as higher boiling or high melting hydrocarbons, for instance, paraffin, naphthalene, dekahydronaphthalene, halogenated naphthalene, diphenyloxide, nitrobenzene or the like may be used as initial substances for the bath.

The above mentioned compounds and substances may be used sometimes per se but usually we have found it advantageous to combine some of these compounds to form a mixture which is especially suitable for the necessary temperatures as well as for the desired reaction. Generally, the composition of the melt will be selected in such a manner that the temperature of the reaction will be counterbalanced between the solidification point and the evaporation point.

EXAMPLES

I. Nitrates

	Degrees Centigrade
30 KNO_3 +70 $LiNO_3$	130
55 KNO_3 +45 $NaNO_3$	218
50 KNO_3 +50 $NaNO_3$	140
50 $NaNO_3$+50 $NaNO_2$	220

II. Chlorides

(a)

	Degrees Centigrade
31 $BaCl_2$+48 $CaCl_2$+21 NaCl	430
50 $BaCl_2$+30 KCl +20 NaCl	540

(b) *Chlorides+carbonates*

50 KCl+50 Na_2CO_3 — 560

(c) *Chlorides+fluorides*

85 $CaCl_2$+15 CaFi — 645

(d) *Chlorides+sulfates*

35 NaCl+65 Na_2SO_4 — 620

(e) *Chlorides+phosphates*

35 K_3PO_4+67 KCl — 720

(f) *Chlorides+borates*

83 $BaCl_2$+7 $Na_2B_4O_7$+5 MgO — 980

(g) *Chlorides+carbonates+sulfates*

40 NaCl+20Na_2CO_3+40 Na_2SO_4 — 500

III. Chromates

50 $K_2Cr_2O_7$+50 $Na_2Cr_2O_7$ — 300

IV. SULFATES

25 K_2SO_4+75 Na_2SO_4	830

V. PHOSPHATES

70 $Na_4P_2O_7$+30 $K_4P_2O_7$	875
44 $K_4P_2O_7$+56 KPO_4	615

VI. SILICATES

45 $BaSIO_3$+55 Na_2SiO_3	905

VII. BORATES

50 $NaBO_2$+50 $LiBO_2$	648

VIII. BROMIDES

50 KBr+50 NaBr	640

The regulation and maintainance of the suitable temperature of the reaction may be carried into effect by external heating, but we prefer mostly to use internal heating. If the reactions are of an exothermic nature the liberated heat may be used for internal heating, for instance in such a manner that the conversion is combined with an other exothermic reaction or combustion. We have found it advantageous to use flues or dipping burners for internal heating, whereby the dipping burners may be arranged in a chamber adjacent to the reaction chamber in such a way that no mixture of the combustion gases with the reaction products takes place. The heating may also be effected by means of an electric current, for instance, by resistance heating or by heating through electrodes whereby the salt melt acts as an electrolyte and the alternative current may be conducted through electrodes in contact with the electrolytes. Furthermore, we have found it useful, to combine various heating means, for instance in such a manner that the main heat supply will be effected by means of dipping burners or flues whereas the fine adjustment will be carried out by resistance or electrode heating. Moreover, the use of internal heating has the advantage that the walls of the melting vessel may be made out of metallic as well as out of ceramic material and hence be adapted perfectly to the thermic and chemical stress.

If the heating is carried out with electrodes the latter may either act chemically or catalytically or influence the conversion in a favorable manner. We have found it advantageous to use graphite electrodes with the manufacture of hydrocyanic acid ex carbon monoxide and ammonia, whereby the electrodes may deliver the carbon as well as remove the undesired oxygen.

By carrying out our invention we proceed sometimes in such a way that the substances to be introduced into the melt are subjected to a pre-heating and may then be used for internal heating or adjustment of temperature. The preheating of the substances to be introduced may be effected with the waste heat, for instance, coming from the flues. Excessive introduction of reaction participants or additional introduction of inert gases or vaporous substances will also lead to the formation of excessive heat.

Furthermore, the introduction of gaseous or vaporous substances into the melt may be used to blow liquid or finely divided solid substances into the melt.

As we have already mentioned, the melts may be used or their composition selected in such a manner that they may act specifically or catalytically per se. Certain oxidising reactions may be improved by introducing of boric acid or borates or barium compounds into the melt. On the other hand, specifically acting catalysts, insoluble in the melt, may be used either alone or in combination, for instance, in such a manner that they are suspended in the melt in a finely or extremely finely powdered condition. Catalysts which tend to deposit in the melt or to rise therein, may be precipitated on suitable carriers which do not liquate and may be suspended in the melt.

As catalysts various elements and compounds such as for instance, metals, metal compounds, earth acids or salts may be used. For instance, hydrogenations may be carried into effect with the aid of the usual hydrogenation catalysts, such as nickel, iron, molybdenum, tungsten, zinc oxide. Oxidations may be carried into effect in the presence of oxidation catalysts, such as for instance, iron oxide, vanadic acid and so on; splitting off water will be carried out in the presence of aluminium oxide, titan dioxide, earth alkali phosphates and so on. Carriers for catalysts, which themselves tend to deposit, are aluminium oxide, voluminous or active silica, asbestos, magnesium oxide, beryllium oxide, charcoal, activated charcoal; carriers for ascending catalysts are, for instance, heavy metals, such as tungsten, copper and the like.

Our invention has been proved especially suitable for the carrying through of reactions which require high temperatures as well as for the maintainance of a constant temperature, such as for instance, the manufacture of acetylene or ethylene from methane. Furthermore, our invention is extraordinarily well suited for the carrying out of partial oxidation reactions as for instance, the manufacture of phthalic acid or maleinic acid by oxidation of aromatic hydrocarbons; or, for the manufacture of carboxylic acids, ketones, aldehydes or alcohols by partial oxidation of methane or its homologues.

Our invention may be carried out at usual pressure, under vacuo or at increased pressure, also at high and very high pressure. If it occurs that considerable quantities of the melt are carried over in a vapor- or mist like form together with the reaction products, these quantities may be collected in an absorption bulb and re-conducted into the melting vessel. The melts as well as the catalysts therein may be regenerated during the operation, for instance, in such a manner that one part of the melt will be passed over into a chamber adjacent to the reaction chamber, where it will be subjected to a regenerating treatment, for instance, by means of water vapor or oxidising gases and afterwards reconducted into the reaction vessel.

WALTER BECK.
HANS WALTER.
KLAUS BONATH.

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ALIEN PROPERTY CUSTODIAN

PROCESS OF PRODUCING ARTIFICIAL RESINS

Kurt Nagel, Frankfurt A/M., Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 5, 1939

The present invention relates to a process for the production of condensation products of pentaerythritol with polybasic organic acids and monobasic aliphatic acids containing more than five carbon atoms.

The production of artificial resins by the condensation of pentaerythritol with polybasic acids has been known for a number of years. However, these resins because of certain undesirable characteristics, even though they had many valuable properties especially for application in the electrical industry, have not been introduced into the art. The prior art resins suffered from several drawbacks. For example, the condensation products were not completely clear and did not retain their form and shape. The prior art resins of this class were affected by moisture and were not completely resistant thereto. In addition, the hardened product did not possess constant properties.

I have discovered that the drawbacks of the prior art pentaerythritol resins may be overcome in a simple but efficacious manner.

It is an object of the present invention to provide a process for manufacturing condensation products of pentaerythritol with polybasic organic acids and monobasic aliphatic acids containing more than five carbon atoms.

It is another object of the present invention to provide pentaerythritol-polybasic organic acid resins which are completely clear and have great stability of form and shape.

It is a further object of the present invention to provide condensation products of pentaerythrithritol and polybasic organic acids which are highly resistant to and practically unchanged by moisture.

It is also within the contemplation of the present invention to provide a hardened product of the condensation of pentaerythritol and polybasic organic acids which has substantially constant properties.

The present invention likewise contemplates a process for the preparation of condensation products of pentaerythritol and polycarbonic acids together with aliphatic acids containing more than five carbon atoms.

Other objects and advantages will become apparent to those skilled in the art from the following description.

Broadly speaking, I have discovered that the various disadvantages and undesirable properties of the prior art pentaerythritol-polybasic organic acid condensation products may be overcome by employing pentaerythritol in a purified state. The pentaerythritol obtainable in commerce, even when it has a high melting point, contains greater or lesser quantities of contaminants such as sugars, aldehydes, formic acid and the like which influence the melting point of the pentaerythritol to no considerable extent. Even the so-called pure pentaerythritol is contaminated more or less by admixtures of one or more of the aforementioned contaminants. For example, even pentaerythritols having melting points of about 253° C. are not completely free from deleterious contaminants. Thus, it can be readily appreciated that the melting point of a pentaerythritol is not a sensitive enough characteristic of the material to be used as the sole means of determining its applicability in the process of the present invention.

The quantity of deleterious substances, particularly reducing substances, in the unpurified pentaerythritol may be determined by titration with Fehlings' solution or by means of electrometric titration. The best method we have found for this purpose is the titration with potassium permanganate. The pentaterythritol is purified, for example, by washing several times until the titration with a solution of potassium permanganate reaches a minimum which is not reduced by further washing.

In accordance with the present invention, it is preferred to employ pentaerythritol for the condensation process which has been prepared in accordance with the process of the German application D 76 325 IVc/12*o*, corresponding to U. S. application Serial No. 230 426, filed 17.9.38.

In accordance with the process of the aforesaid German application, pentaerythritol is prepared and recovered from solutions containing it by means of concentration and crystallization in the presence of 1 to 10% and preferably 2 to 6% of free acid. Pentaerythritol prepared in accordance with the process of the German application D 77 001, VId/12*o* is likewise adapted to condensation with polybasic organic acids in accordance with the principles of the present invention.

In order that those skilled in the art may have a better understanding of the principles of the present invention, the following illustrative example is provided.

Pentaerythritol obtained by the condensation of acetaldehyde with formaldehyde is recrystallized until there is no appreciable decrease in the quantity of reducing substances as indicated by titration with Fehlings' solution or a solution of potassium permanganate. There-

after, 136 grams of this specially purified product are melted with 292 grams of adipic acid. The melt is maintained at a temperature of about 140°C for a period of time, say about one-half hour. A water-clear, substantially transparent resin is obtained which may be treated in a manner well known to those skilled in the art to produce plastic masses, lacquers, foils, electric insulating masses, either by means of solvents or by taking advantage of the thermoplasticity of the product.

It is possible to employ other polybasic organic acids in place of the aforesaid adipic acid. Thus, phthalic acid, succinic acid, oxalic acid, maleic acid, sebacic acid, tartaric acid, citric acid, aconitic acid and the like may be used in quantities corresponding to the amount of adipic acid indicated in the illustrative example.

Example

After recrystallization as described above 136 grams pentaerythritol are melted with 296 grams of phthalin anhydride. The melt is maintained at a temperature of about 150° for 2 hours. A water-clear, transparent resin is obtained which preferably can be used for producing lacquers and the like, or by further heating at about the same temperature for a longer time it can be made insoluble but very resistant against the influence of acids and lyes.

Furthermore, mixtures of the aforesaid polybasic organic acids or with other polybasic organic acids may be employed. For the most part 2 moles of a polybasic organic acid are taken for one mol of pentaerythritol. When a mixture of different polybasic organic acids is used, generally the same proportion is chosen. Of course the choice of an other proportion is possible.

The products which are obtained by condensing pentaerythritol with a mixture containing polybasic organic acid or acids and higher aliphatic monobasic acids are particularly well adapted for use in preparing electric insulating lacquers. Furthermore by addition of monobasic acids containing more than five carbon atoms the mechanic properties of the resin are improved very much. Thus, such resins show a considerable elasticity and in addition, they possess a greater tending strength.

In order to provide those skilled in the art with an illustrative embodiment, attention is directed to the following example.

From the recrystallized pentaerythritol 136 grams are melted with 110 grams of pure adipic acid and 111 grams phthalic anhydride and 116 grams of caproic acid are mixed into the melt by stirring. Then the melt is maintained during 2 days at about 130° under diminished pressure and then warmed still during further days at about 160° at the normal pressure.

Finally two comparison samples are enclosed. Both are produced under exactly the same conditions, and the initial materials of both only differ in the used pentaerythritol. In the sample marked with No. 1 corresponding to our invention a very pure pentaerythritol, obtained by repeated recrystallization, is used the potassium permanganate value of which was only 1,2, while in the sample marked with No. 2, a customary pentaerythritol was employed which indicated a potassium permanganate value of 30.

For both samples always 136 grams of the respective pentaerythritol were mixed with 146 grams of pure adipic acid and 148 grams of phthalic anhydride and the mixture was melted at 160°. After filtration the melt was warmed at about 130° during three hours at a pressure of 15 m/m. Then it was poured into molds in which it was slowly heated to 160° and then maintained at this temperature during 24 hours. The difference in the both samples is so evident, that no further words are necessary therefor.

Although the present invention has been described in conjunction with certain embodiments thereof, it is to be understood that variations and modifications may be made as those skilled in the art will understand. Such variations and modifications are to be considered within the purview of the specification and the scope of the appended claims. Thus, mixtures of polybasic organic acids and aliphatic monobasic acids containing more than five carbon atoms may be employed with pentaerythritol to obtain condensation products having particular properties.

KURT NAGEL.

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ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF PENTAERYTHROL

Kurt Nagel, Frankfurt-on-Main, and Franz Koenig, Walldorf near Frankfurt-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 24, 1939

The present invention relates to the manufacture of artificial resins by condensing pentaerythrol with organic acids and to a process for producing a pentaerythrol of high melting point and to the product of said process.

Formerly, the condensation of pentaerythrol with acids, such as phthalic or succinic acid, was carried through until the removal of water vapor from the reaction mixture was finished. Afterwards, when trying to harden these masses, they became porous. Therefore, these artificial masses could not be used for producing clear moulded bodies or articles requiring clarity of composition.

An object of the invention is to improve the quality of the resins, of the method of production, and of the quality of the pentaerythrol.

Another object of the invention is to provide a new material useful for electrical purposes, especially for covering electric wires with an insulating layer of lacquer containing pentaerythrol resins.

It is also an object of the invention to provide a process for producing a relatively pure form of pentaerythrol having a high melting point.

A further object of the invention is to produce pentaerythrol with a melting point up to about 257° C. or higher.

Other and further objects and advantages will become apparent from the following description.

Broadly stated, according to the present invention, the mixture of pentaerythrol and organic acids, especially polybasic acids, is subjected to a ripening process after condensation. This ripening process consists of a continued heating at higher temperatures, preferably in vacuo.

It is not yet quite clear which reactions cause this ripening. In many cases, after ripening for some time, the liberation of small quantities of water can be noticed. Thus, the ripening can also be effected by heating at ordinary, elevated, or reduced pressures, preferably in the presence of hygroscopic substances, such as gypsum, sodium sulfate, or acetic anhydride. The masses, ripened according to the present invention, can be hardened in any known manner, e. g., by raising the heating temperature or by continuing the time of heating.

The hardening process is favored by adding acidic substances, such as sulphuric acid, phosphoric acid, boric acid, sodium bisulphate, monochloracetic acid, and benzol sulphonic acid. It is also possible to bleach the masses by adding bleaching substances, especially if the masses are not purified instead.

For the purpose of giving those skilled in the art a better understanding of carrying the invention into practice the following illustrative examples are given.

Example No. 1

About 136 grams of pentaerythrol are melted with about 290 grams of adipic acid and left at about 140° C. for about half an hour. After this time, when the liberation of water vapor is about finished, the reaction mixture is ripened at about 130° C. in vacuo for about 1½ hours, whereafter the product is left under ordinary pressure and at a moderate temperature, i. e. in this case, at about 120° C., for about one-half hour.

Instead of adipic acid, other acids, such as phthalic acid, succinic acid, oxalic acid, maleic acid, sebacic acid, tartaric acid, citric acid, and aconitic acid, or mixtures thereof, can also be used. Together with pentaerythrol, other polyhydric alcohols, such as glycerol, glycol, and mannitol, can be reacted according to the invention. The reaction mixture can contain other substances able to condense or polymerize to form resins, such as phenolic-formaldehyde, vinyl ester or other vinyl compounds, such as acrylic derivatives, styrene, etc.

It has been found that polycarbonic acids with long chains, such as adipic acid or pimelic acid, cause soft polymerization products to be obtained, having qualities similar to those of caoutchou or butadiene polymers. On the other hand, hard masses, which may be used as artificial glass, can be produced by reacting pentaerythrol with oxalic or phthalic acids. Generally, the hardness of the product is varied by regulating the duration and the temperature of the ripening process.

The resols, obtained according to the ripening process disclosed herein, can be immediately subjected to a hardening process by heating for from about 1 to about 3 hours at temperatures of about 160° to about 180° C. These hardened resols are easily handled for storing or shipping. They can later be moulded by hardening in any desired manner.

Example No. II

About 137 grams of pentaerythrol and about 332 grams of phthalic acid, or about 296 grams of phthalic anhydride, are melted together and kept at about 140° to about 150° C. for about 25 minutes. After the liberation of water vapor has ceased, the reaction product is cooled to about 120 to about 130° C. and left at this temperature is vacuo for about 20 to about 40 minutes,

after the addition of gypsum. The masses obtained by this process can then be treated as in Example No. I.

It has also been found that an excellent lacquer for covering and insulating metal electric wires is obtained by condensing pentaerythrol with aliphatic saturated carbonic acids containing more than 5 carbon atoms in the molecule. Mono-, as well as polybasic acids can be used for this purpose, e. g. caprylic acid, acid, adipic acid, stearic acid and lauric acid. It is preferred to use those mono-basic acids which contain about 8 to about 12 carbon atoms, especially the mixture of fatty acids taken from the oxidation of paraffin.

The lacquer made from these condensation products possesses excellent adhesive qualities with respect to the metal wires. The wires can be bent without destroying the covering resin layer, and the lacquer films do not get brittle with time, in contrast with lacquer made with the aid of softening agents. It is a special advantage of these products that they can be used as metal wire lacquers without any addition of a softening agent, if necessary.

In covering metal wires with the lacquer, it is preferred to do so by dissolving the condensation products in a suitable solvent or by using them in the molten state. In the latter method, it is necessary that the condensation products be partially or wholly in the socalled A-stage, that is, in the first stage immediately after the condensation, when no hardening or no insolubility has been begun. The covered wire is put in an oven having a temperature of about 180 to about 250° C., whereby the lacquer becomes infusible or, at least, fusible with difficulty. Of course, it is desirable, but not necessary, to ripen the resins before applying them to the wire in the manner described above. The coverings may contain, in addition, other artificial resins which are electrically highly valuable, such as polystyrene, as well as phenol-formaldehyde resin, urea resins, vinyl resins, or chlorinated caoutchouc, which may be added to the molten lacquer or to the solution of the resins. It is also possible to add hardening oils.

Example No. III

About 136 grams of pentaerythrol are melted with about 292 grams of adipic acid at about 160° C., and thereafter ripened at about 130° C. A wire with a diameter of about 0.03 to about 3 mm. is drawn through this molten mixture at about 110° C. in such manner that it is homogeneously covered with the lacquer, while an eventual excess is removed by an apparatus for stripping it off. The wire is led through an oven having a temperature of less than about 400° C. The lacquering and enameling can be repeated several times. After being cooled, the layer is completely soft and dense, fast against high voltage, and free from pores, as shown by examination.

The condensation product for the lacquer can also be dissolved in a solvent, such as ethanol, and can be applied in the form of such a solution. The solvent is such as to give a homogeneous cover after evaporation. It is therefore preferable to add higher boiling alcohols to the solvent.

Special advantages of the lacquer are that it does not flow away when heated to higher temperatures and that its chemical and physical stabilities remain unchanged for years.

As a starting material, it is preferred to use a relatively pure pentaerythrol of high melting point, and the present invention provides for the production of such pentaerythrol. The pentaerythrol thus formed is well adapted for use in the production of the resins described herein or of explosives.

Broadly stated, the present invention provides for the production of a pentaerythrol having a melting point up to about 257° C. or even higher. This is obtained by concentrated solutions containing pentaerythrol in the presence of sufficient free acid to give a concentration of free acid from about 1 to about 10%, and preferably from about 2 to about 6%, in the concentrated solution, and thereafter crystallizing pentaerythrol from the solution. As free acids, sulphuric, phosphoric, benzene sulphonic, and acetic acids, and the like, can be used.

The process disclosed in this invention is very useful in the production of pentaerythrol from acetaldehyde and formaldehyde. In this process, formaldehyde and acetaldehyde are reacted together in an aqueous medium in the presence of alkaline substances, such as calcium hydroxide. The aqueous reaction solution contains pentaerythrol, di-pentaerythrol ether and other products. In order to separate the pentaerythrol therefrom, the alkaline condensing agent is neutralized, and the solution is concentrated so that crystallization occurs. According to the invention, care is taken that this crystallization takes place in the presence of sufficient quantities of free acid. It is preferred that the free acid be already present during the concentration of the solution by evaporation. It is assumed that, under these circumstances, chemical reactions take place which are important for obtaining very pure pentaerythrol, but which take a certain time for development.

As mentioned above, it is necessary that the quantities of free acid which must be present be between about 1% and about 10% of the volume of the concentrated solution. It is preferred to use strong acids, mineral acids or benzene sulphonic acid, when isolating the purest pentaerythrol immediately from the reaction mixture. The yield of solid matter appears to be smaller than that obtained by the prior art, and it is assumed therefrom that the older processes yielded only pentaerythrols which were contaminated with large quantities of impurities. If purification of these formerly produced impure products by repeated crystallizations is attempted, the yields obtained are lower than the limit of the yields obtainable by the present invention. Moreover, by the former methods it was not possible to obtain such pure products as can be produced by the present process.

Example No. IV

An apparatus which is provided with a stirring device and cooling coil is filled with about 1200 liters of water and about 400 kilograms of about 30% formaldehyde, so that the concentration of formaldehyde is about 7½% by weight. Over a 6 hour period about 44 kilograms of acetaldehyde in 25% solution and about 42 kilograms of finely powdered calcium hydroxide are added in half-hourly portions. The temperature is kept at about 15 to about 16° C.

After the condensation is finished, sulphuric acid is stirred into the reaction mixture in such quantity as to change all of the calcium hydroxide to calcium sulphate and, besides that, to provide sufficient excess acid so that the final con-

centrated volume will contain from about 2.6 to about 2.8% of free acid. After separating out the precipitated calcium sulphate, the clear solution is concentrated at about 90° C. to about $\frac{1}{10}$ of the initial volume. This remaining volume determines the percentage of the free acid present, according to the invention. The concentrated solution is then caused to crystallize, and the crystals are centrifuged and washed with a small amount of water. The product is further purified by one single recrystallization in water. A yield of about 45% of a pentaerythrol with a melting point of about 255° C. is obtained.

Of course, it is also possible to purify crude pentaerythrol by using the hereindescribed process. For this purpose, the crude product is dissolved in water, a sufficient quantity of sulphuric acid is added, and the solution is heated for some time, concentrated, and made to crystallize. Even a solid crude pentaerythrol can be subjected to a treatment with free acids in order to purify it. In this case, it is preferable to use relatively weak acids, such as acetic acid. Generally, however, the steps of the invention provided for the production of pentaerythrol itself are as shown in the preceding paragraphs.

KURT NAGEL.
FRANZ KOENIG.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE FLOTATION OF NON SULFIDIC CONGLOMERATIONS

August Götte, Francfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 1, 1939

My invention relates to a process for the flotation of non sulfidic conglomerations containing quartz, aluminium oxide and the like, for instance fluor spar, (calciumfluoride) tin stone (tin oxide), feldspar, heavy spar (bariumsulfate) and so on.

Hitherto the flotation of, for instance, fluor spar was carried out with substances such as oleic acid and its esters, pine oil, tar oil, sulfonated fatty acids and the like.

Now it was found by thorough investigations that the flotation of substances as mentioned above will give excellent results if flotation means are used which contain sulfonated, preferably highly sulfonated castor oil as foamer and fatty alcohol sulfonates, especially sulfonated higher fatty alcohols, such as hepta decyl alcohol, cetyl alcohol and/or vegetable oil sulfonates as collectors. It has been proved advantageous to use commercial products, consisting wholly or partly out of higher fatty alcohols such as are used in the textile industry. Instead of or besides sulfonated fatty alcohols, substances which are known as "Igepale" (auxiliary means in the textile industry) may, for instance, also be utilized.

The above mentioned additions, such as fatty alcohol sulfonates and/or vegetable oil sulfonates may either wholly or partly be substituted by soaps, such as for instance, soda soap, potash soaps (soft soaps, oleate soaps and so on) or by pyridine bases, for instance, pure or crude pyridine and its homologues such as picoline, lutidine, further chinaldine and the like. Furthermore, the addition products of ethylene to alkyl tetra hydronaphthol or of ethylene oxide to turpentine wood oil and the like may be used.

According to my invention the above mentioned ingredients, such as fatty alcohol sulfonates, vegetable oil sulfonates soaps, pyridine bases and addition products may be added to the sulfonated castor oil either alone or in combination. The components of the mixture may be utilized in the form of pure or substantially pure products or in the form of less pure commercial products or as raw materials.

Other auxiliary means, such as for instance, wetting agents, emulgators or the like may be added to the sulfonated castor oil or the mixtures containing the sulfonate castor oil.

Sort and quantity of the addition substances depend inter alia on the kind of the conglomeration, ratio of quantity of the substances contained therein, quality of the flotation water and so on. The optimal proportions of mixture will be found easily by some preliminary tests.

The ratio of quantity may be chosen in such a manner that the mixture contains of about 80–90% of sulfonated castor oil and of about 10–20% additional substances of the above mentioned kinds, either alone or in combination.

The amount of the flotation means depends on the kind of the material to be treated and on the contents of the conglomeration or pulp respectively. In general, quantities of about 0,5–2 kgrs. of the mixture will be utilized per ton conglomeration.

Examples

1. Ground fluor spar is flotated with a mixture, consisting of 8 parts by volume of highly sulfonated castor oil and 2 parts by volume of a fatty alcohol sulfonate, known under the trade mark "Brilliant-Avirol." 1 kg. of the flotation means is used of 1 ton of the conglomeration.

2. Ground heavy spar is flotated with a mixture which consists of about 90% parts by volume sulfonated castor oil and a suitable amount of a known wetting agent with 10 parts by volume of soft soap. About 1,5 kgrs. of the flotation means are used for 1 ton of heavy spar.

According to my invention the use of the flotation means has the advantage that the flotation is carried out quicker and better than with the addition of other known substances, as already mentioned. Equal amounts of chemicals within given times will yield better results of concentrates, for instance, fluor spar concentrates, in comparison with the hitherto known methods. The flotation means according to my invention have also the advantage that they are easily soluble in water and in consequence well to be measured.

If desired, the flotation may be carried out advantageously at elevated temperatures. Thus, the working up of fluor spar may be carried out, for instance, at temperatures of about 30–50° centigrade, whereby the amount of flotation means may be diminished accordingly. With multi step working, for instance, only one step may be done at elevated temperature.

According to my invention a combined table concentration with a flotation may be carried out with advantage. This will be done in such manner that the raw conglomeration mixed with water to form a pulp is then brought into contact with a mixture of flotation means according to my invention, whereupon the pulp treated with the flotation means is subjected to the usual sorting on a table concentrator. This facilitates the separation of grain sizes which otherwise would not be able to be sorted with the usual flotation.

AUGUST GÖTTE.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE BLEACHING OF CELLULOSES OBTAINED BY ALKALINE PROCESSES

Emil Scheller, Lorsbach/Taunus, and Wilhelm Gärtner, Darmstadt, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 1, 1939

As a matter of fact cellulose obtained by alkaline processes, such as soda and sulfate celluloses can only be bleached with difficulty to yield a good white color without any loss of stability. All bleached soda or sulfate celluloses hitherto known do not fulfil the requirements with respect to the grade of whiteness or their stability has been attacked much more that with bleached sulfite celluloses. Some unrefined bleached kraft celluloses were recently handled showing a grade whiteness nearly similar to that of bleached sulfite celluloses. This progress, however, was due to undesired heavy losses in stability. The increase in the contents of white was only possible by boiling a special bleachable material with a considerably stronger grade of decomposition but also with greatly diminished qualities of stability. As further losses in stability are unavoidable in a bleaching, it is obvious that with a very strong chlorine bleaching the desired high figures of stability which are found otherwise in unbleached kraft celluloses would be entirely lost.

According to my invention I have found that it is possible to bleach celluloses obtained by alkaline processes in such a way that a material results, not only with a pure white color but also distinguished by a very good stability.

The invention relates to the treatment of celluloses with a combined bleaching method by utilizing hypochlorite and alkaline hydrogen peroxide solutions or peroxides respectively. The various steps of the hypochlorite bleaching and the peroxide bleaching may be varied accordingly. If desired, several bleaching steps with hypochlorite or peroxide may be combined in any variation.

According to my invention the raw material consists in celluloses obtained by alkaline processes, as for instance, soda celluloses or sulfate celluloses.

Furthermore I have found that it is advantageous to treat the cellulosic material before the real bleaching with elementary chlorine in the form of aqueous solutions of chlorine. By this process the bleaching treatment will be improved and accelerated. I may carry out my invention also with a combination of the combined bleaching with an acidification process. It is possible to acidify at the end of the whole treatment or after each bleaching step with hypochlorite or hydrogen peroxide or peroxides respectively. This acidification causes in many cases a specially intensified clarification, especially if some active chlorine is present from the last bleaching step. According to my invention the bleaching means are firstly sodium hypochlorite or other hypochlorites, especially electrolytically produced bleaching lye and, secondly hydrogen peroxide or alkaline reacting peroxide solutions which form hydrogen peroxide, sodium percarbonate, sodium perpyrophosphate and the like. If hydrogen peroxide is used the bleaching bath must be made alkaline by addition of sodium carbonate, caustic soda or the like.

In many cases a special advantage was observed if, in general, the alkalinity of the bleaching bath, i. e. the baths containing hypochlorite as well as peroxide, was kept low. Too high an alkalinity may have a decomposing or harmful effect if molecular oxygen or air are present. The alkaline content of the bleaching baths should therefore not exceed 5 grs.—advantageously less than 2 grs.—calculated as sodium peroxide, per one liter of the bleaching bath.

My invention may be modified to a considerably extent. For instance, in the first step, the cellulose may be chlorinated in a usual manner with elementary chlorine whereby it has been observed that celluloses obtained by alkaline processes absorb the chlorine somewhat slower than sulfite celluloses. In consequence, the chlorine is added slowly and an excess thereof is kept for a longer time, for instance, 30 minutes in contact with the cellulose. When the chlorine is absorbed still slowly, the cellulose is treated with caustic soda either after a short washing to remove the main quantity of the formed hydrochloric acid and the excess of chlorine, or without any washing and finally washed out.

The second step may be varied likewise. One embodiment of my invention comprises the first treatment of the cellulose with hydrogen peroxide in an alkaline medium, i. e. with addition of caustic soda, lime and the like or sodium peroxide, during one or two hours at about 35–40° C., whereby even elevated temperatures, for instance, about 55° C. are allowable. The rate of peroxide is such that it is spent in this time. Thereafter active chlorine, for instance, in the form of a chlorine lime solution, is added the cellulose and treated until the content of active chlorine decreases no more or only slowly. The material was then acidified and thoroughly washed. If desired, the material may be washed out after the peroxide treatment. With the acidification the material brightens usually extraordinarily.

An alternate method of proceeding in accordance with my invention consists in a preliminary bleaching with active chlorine in a known way

until the utilized chlorine is wholly or nearly wholly consumed. If desired, the material may then be washed for a short time and afterwards the peroxide added in the above described manner, the material is then treated for one to two hours and acidified without any washing.

The invention may be carried out also in the following way: the cellulose is treated accordingly with peroxide, acidified without washing out, whereupon the hypochlorite solution is added directly, either after a preliminary short washing or without any washing. The material is then treated according to my invention.

Or, the peroxide treatment may be inserted without washing between two treatments with hypochlorite, whereby the acidification is carried out only after the second treatment with hypochlorite, as described.

A further increase of the whiteness may be effected in such a way that in the third step the cellulose is treated respectively with active chlorine and/or peroxide, then acidified slightly, either with or without washing out, and finally washed out thoroughly.

In all cases a cellulosic material is obtained with a considerably increased whiteness in comparison with the hitherto known bleached soda and sulfate celluloses. The whiteness is nearly the same than that of highly bleached sulfite celluloses or even just the same. Which of the above mentioned variations is carried into effect, depends on the quality of the raw material.

The use of the peroxide bleaching bath ensures a considerable saving of chlorine at the bleaching with hypochlorite and furthermore a very remarkable sparing of the fibre in such a way that celluloses treated according to my invention maintain their high qualities of stability. Celluloses which are treated in such a way do not tend to yellowing or whenever only to a very low degree.

Examples

1. A finlandish kraft cellulose was chlorinated with 3,5% elementary chlorine, 3,5% caustic soda directly added and washed out. Thereafter the material was treated with 0,8% Na_2O_2 at 35° C., whereby the peroxide was spent after 1,5 hours, then added 2,5% hydrochloric acid, without preliminary washing out; immediately thereafter 0,25% active chlorine as calcium hypochlorite solution are added. The chlorine was entirely spent after 7 minutes, whereupon the material was washed. Now 1% active chlorine was added at 35° C.; after 4 hours 0,68% thereof was spent. Then the material was acidified directly with 2% hydrochloric acid and thoroughly washed.

2. Swedish soda cellulose was chlorinated with 2,7% of elementary chlorine, shortly washed, alkalised with 1,3% caustic soda and washed. Thereupon 0,5% hydrogen peroxide and 0.5% caustic lime were added and the material treated at a temperature of 35–40° C. The peroxide was spent after one hour; 1,32% active chlorine was then added directly in the form of a chlorine lime solution. After 2,5 hours the chlorine was spent up to 0,24% whereupon the material was acidified without washing and finally the cellulose was washed down to a pH of 7.

3. German kraft cellulose was treated with 0,4% elementary chlorine, alkalised and washed. Then 1% Na_2O_2 was added at 35° C. which was spent after 1,5 hours. Now the material was acidified with 3% hydrochloric acid and immediately thereafter 1,0% active chlorine in the form of chlorine lime solution was added. The chlorine was spent after 15 minutes; afterwards the material was washed out. Then the material was treated once more with 1,5% active chlorine in an alkaline medium at 35° C. After 2,5 hours when only a trace of chlorine was yet to be found, the material was acidified and washed. Whilst the viscosity of the unbleached cellulose in a copper ammin solution was 944 CP, the bleached cellulose had a viscosity of 312 CP.

4. German kraft cellulose was treated with 4% elementary chlorine, as mentioned above, alkalised and washed out, then treated with 1,5% Na_2O_2 at a temperature of 35° C. After 3 hours the peroxide was spent, whereupon the material was acidified and washed. Then the material was further bleached with 2% active chlorine at 35° C. and, after consumption of the main quantity of the chlorine, acidified.

5. A kraft cellulose was chlorinated with 6,5% elementary chlorine, shortly washed, alkalised with 1% NaOH and thoroughly washed. Afterwards the material was treated with 1% Na_2O_2 at 35° C., until the peroxide was spent after 3 hours, then acidified and immediately 1% active chlorine as chlorine lime solution added. The chlorine was spent after 10 minutes. Now the material was washed out and further bleached with 1,5% chlorine at 35° C. After 6 hours 1,24% of the chlorine were spent, whereupon the material was acidified and washed out. The viscosity of the bleached cellulose was 431 CP, whilst the unbleached cellulose showed a viscosity of 1593 CP.

6. A kraft cellulose was treated with 0,5% Na_2O_2 at 35° C. without former chlorination. The peroxide was spent after 3 hours, whereupon the material was acidified and 1% Cl_2 added in the form of $CaOCl_2$. After a duration of 5 minutes the chlorine was spent; the material was then washed thoroughly. The material was finished in the second step with 2,5% active chlorine at 35° C., acidified with hydrochloric acid and washed out.

7. After a preliminary chlorination with 6,5% Cl_2 the kraft cellulose was washed and alkalised with 1% NaOH and again washed. In the second step 0,75% Na_2O_2 were added at the beginning and after its consumption 1% active chlorine was added. The chlorine was spent after 2 hours, whereupon the material was acidified with hydrochloric acid and then washed. In the last step 0,4% active chlorine were sufficient to obtain the desired high grade of whiteness.

8. The preliminary chlorination of a kraft cellulose required 1,6% Cl_2. The material was washed shortly and alkalised with 1% NaOH and again washed. Now the material was treated with 0,5% active chlorine and after the absolute consumption of the chlorine, the cellulosic material further treated with 0,3% Na_2O_2. The cellulosic material was acidified with hydrochloric acid and washed. The finishing was made with 0,6% active chlorine, whereupon the material was acidified and washed accordingly.

EMIL SCHELLER.
WILHELM GÄRTNER.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE RECOVERY OF CELLULOSES SUITABLE FOR THE MANUFACTURE OF PHOTOGRAPHIC PAPERS

Emil Scheller, Lorsbach/Taunus, and Wilhelm Gärtner, Darmstadt, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 10, 1939

The cellulose which is used for the manufacture of papers for photographic purposes should be almost free from reducing substances which may exert a deleterious effect upon photographic emulsion layers sensitive of light.

Object of our invention is a process for liberating the celluloses from the above mentioned unfavourable reducing substances in a simple and sure manner. Our invention yields even to satisfactory results if relatively very impure celluloses, for instance, straw cellulose is used.

According to our invention the cellulose, in a bleached or, especially, unbleached state is treated primarily with alkali at elevated temperature and under such conditions that no noticeable modification of its content of alpha cellulose occurs; the cellulose is then subjected to a pretreatment with peroxide and afterwards finished with hypochlorite. At the end of the bleaching treatment the material may be acidified. As starting material, according to my invention, all celluloses, as for instance, sulfite cellulose, sulfate cellulose, cellulose obtained by alkaline treatment and the like come into consideration. Thereby cellulose, beech cellulose, cotton or even impure celluloses, such as straw cellulose. According to our invention the treatment with alkali at elevated temperature should be carried out in such manner that no noticeable modification or increase of the contents of alpha cellulose occurs. This may be effected accordingly, for instance, by adjusting the temperature, duration of treatment, strength of alkali or several of these steps in such a way that the contents of alpha cellulose will at least be only insignificantly be altered. Generally, it has proved advantageous not to increase content of alkali in this step over about 5 grs/liter of the bleaching bath. This treatment is followed by a combined bleaching treatment with hypochlorite and peroxide which may be varied accordingly, whereby the bleaching with peroxide may be carried out with hydrogen peroxide or hydrogen peroxide evolving substances, such as sodium peroxide, perborate, percarbonate and the like and if desired, also with caustic soda, lime or other alkalis in small quantities at moderately elevated temperatures. It has proved advantageous to maintain the alkalinity of the bleaching bath in these steps also below about 5%.

After the bleaching treatment the material may be acidified, advantageously when still hypochlorite is present.

The invention is further illustrated by the following example:

Unbleached straw cellulose is treated with 4% caustic soda, calculated on absolutely dry substances, for two hours at a temperature of 100° C. and with a density of material of about 5%. Then the material is treated with 0.3 to 0.5% sodiumperoxide at a temperature of 35 to 45° Centigrade until the peroxide is completely consumed. The product is then finished, acidified and finally washed, whereby an intermediate washing with 2.5% active chlorine (as calcium hypochlorite or solution of alkali hypochlorite) may be inserted, if desired.

EMIL SCHELLER.
WILHELM GÄRTNER.

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Serial No. 303,913

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE BLEACHING OF CELLULOSES

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No Drawing. Application filed November 10, 1939

Our invention relates to a combined bleaching of cellulose by hydrogen peroxide or other peroxides. It is known to bleach with hypochlorite and peroxides whereby the former was added as a last step in the treatment of cellulose in order to improve the grade of whiteness. Hereby not only the grade of whiteness will be improved but also a decrease in yellowing is observed without substantial restriction of strength. However, the bleaching with chlorine had to be carried out in a very cautious manner, to keep the cellulose free from notable quantities of oxycellulose. The disadvantage of these methods consists in a very slow consumption of the active chlorine towards the end of the bleaching process. It is therefore necessary to continue the bleaching with chlorine until the chlorine is practically consumed. Another method comprises the step of washing out after the desired grade of bleaching is obtained in order to avoid the decomposition of chlorine in excess by the peroxide. These methods caused losses in time, power, heat as well as in water or chemicals. Especially the washing out has proved disadvantageous as the contents of the hollander will be cooled down in most cases which necessitates a new heating up to the suitable reaction temperature for the treatment with peroxides.

Now we have found that excellent results will be obtained if the treatment with peroxides will be carried out before the bleaching with hypochlorite. The effect of this reversion of the bleaching steps according to our invention was not to be foreseen. Hitherto the only possibility based on economic considerations seemed to consist in the cheaper pre-treatment of the cellulose with hypochlorite and finishing with the more expensive peroxide to obtain the last bleaching effects. Thorough investigations have, however, shown, that working according to our invention results in an extraordinarily good and permanent bleaching effect, not only in the single steps but also in the combination effect whereby the expenditure of bleaching material is a relatively small one. Furthermore, there is a considerable decrease in the consumption of active chlorine which involves the special advantage of an increased sparing of the fibre material.

Our invention relates to the treatment of all kinds of cellulose, whereby for the carrying out of the various bleaching steps the well known oxygen evolving substances such as hydrogen peroxide, sodium peroxide, perborates, percarbonates and so on may be used whilst for the treatment with chlorine calcium hypochlorite, alkali hypochlorite and the like are utilized. The celluloses which are used as raw material may be subjected, for instance, to a pre-treatment before the bleaching, especially if the celluloses contain relatively larger quantities of incrustations. The cellulose will then be subjected primarily to a treatment with chlorine and subsequent alkalinisation and according to our invention after the alkalinization and the washing process advantageously treated with peroxides. The chlorinated, alkalized and washed cellulose is then treated in a subsequent step, for instance, with hydrogen peroxide or sodium peroxide under maintenance of an alkaline reaction which may be obtained, for instance, by addition of caustic soda, lime and the like. If sodium peroxide is used as oxygen evolving medium the further addition of caustic soda or the like may be omitted. In any case it has proved advantageous not to use too high a concentration of alkali in the bleaching bath, for instance, about 5 g or less, better less than 2 g per liter bleaching bath and based on sodium hydroxide. The amount of peroxide is so that it will be consumed in about one to two hours at a working temperature of 35–55° C. These temperatures may be further increased sometimes according to the stability of the bleaching bath and the quality of the treated bleaching material.

After the bleaching treatment with peroxide the after treatment with active chlorine according to our invention may be carried out in such manner that the hypochlorite solution is added immediately to the bleaching material or, especially, with higher temperatures the bleaching bath is first cooled down to temperatures of about 35° C, whereby a second washing process may be inserted and then treated with hypochlorite. The bleaching with chlorine is then continued until the desired grade of whiteness is obtained, whereupon the bleaching material is acidified and washed.

A further improvement of the grade of whiteness may be obtained by acidification at a time when the bleaching bath contains only small quantities of active chlorine and the subsequent washing out will afterwards be carried out immediately. This treatment may be combined with further subsequent bleaching treatments. For instance, a further treatment with peroxide may be inserted after the last treatment with hypochlorite.

EMIL SCHELLER.
WILHELM GÄRTNER.

[illegible]

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Serial No. 306,199

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE DISPOSAL OF WASTE CYANIDE SOLUTIONS

Helmut Beier, Frankfurt A/Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 25, 1939

My invention relates to a process for the disposal of waste cyanide solutions, more particularly of solutions which contain practically no metal salts.

Hitherto it was known to convert waste solutions or liquids containing cyanide, copper and, for instance, other metals, such as zinc, into non-toxic solutions by a treatment with caustic potash, lime or the like whereby the grade of alkalinity is specially adjusted for the oxidising treatment. In order to obtain a practically complete conversion of the cyanide into cyanate and copper the waste liquids are treated with oxidising means such as halides, for instance, chlorine, hypochlorite, hydrogen peroxide and the like at elevated temperature until all cyanide is completely converted into cyanate and copper in its bivalent form. The copper oxide which is precipitated from the alkaline solution is then separated from the detoxicated solution.

Object of my invention is a process for the disposal of cyanide containing liquids, more particularly, waste solutions which contain practically no metal salts. These waste solutions will be found, for instance, at case hardening processes of iron and steel with cyanide or, generally, at industries where hydrocyanic acid is present in the waste solutions.

According to my invention the detoxication of the cyanide containing waste solutions which are substantially free from metal salts, is carried out in such a manner that the solutions are adjusted to the suitable degree of alkalinity by alkaline substances whereupon the cyanide containing solutions are subjected to an oxidising conversion treatment with the formation of a cyanate.

The solution may be rendered alkaline by caustic potash, soda, caustic lime, furthermore in combination also, for instance, of caustic lime and caustic potash. As suitable oxidising means halides, particularly chlorine, hypochlorite, for instance, sodium hypochlorite or calcium hypochlorite, further hydrogen peroxide and the like may be utilized.

The oxidising treatment may be carried out either at room temperature or at elevated temperature, for instance, at about 40 to 80° centigrade. This treatment is continued until all cyanide has been converted into non-toxic cyanate. The cyanate undergoes thereby a more or less extensive saponification.

I have found that waste solutions or the like which are alkaline per se can generally not be treated according to my invention without a further addition of alkaline substances, such as caustic potash or caustic lime, in order to secure a smooth and complete running of the oxidation. The amount of the alkaline addition substances depends on the kind of waste liquor, kind of addition substances and kind of the oxidising treatment. The grade of alkalinity which is best suited for the oxidation may easily be detected by simple preliminary tests.

It has been found advantageous to use quick lime for the alkalinisation of the solution whereby the heat thereby developed may be utilized for the heating up of the solution itself. In the same way, for instance, the introduction of chlorine in strong alkaline solutions yields heat of neutralisation which may be used for the above mentioned process.

Examples

1. 200 grs of bleaching powder or equivalent quantities of any hypochlorite (about 35% active chlorine) are added at room temperature to 25 ltrs of a cyanide containing waste liquid with a content of 1 g KCN/liter which is made alkaline by 200 grs caustic soda. The suspension is stirred for some time and afterwards filtered. The filtrate is free from cyanide.

2. 400 grs slaked lime and 400 grs bleaching powder are added to 50 liters of a cyanide containing waste solution with 1 g KCN/liter. The dissolved mixture is stirred for some time and clarified by deposition. The water separated from the precipitate is detoxicated.

3. In 50 ltrs of a waste solution, made alkaline with 400 grs of slaked lime and heated to about 40 to 60° C., with a content of 1 g KCN/liter, chlorine is passed under stirring until the whole cyanide is oxidised or the hereby formed cyanide partly or wholly saponified under development of ammonia and formation of bicarbonate.

HELMUT BEIER.

Published July 13, 1943 Serial No. 321,788

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF BERYLLIUM CEMENTED METALLIC ARTICLES

Hans Bernstorff, Francfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 1, 1940

Object of my invention is a process for the manufacture of metallic articles which are predominantly subjected to surface abrasion, such as for instance, bearing boxes, cylinder walls, piston rings or collecting brushes.

Hitherto, bearings for special purposes have entirely been made of beryllium alloys, for instance, from a copper beryllium alloy. Moreover, it was suggested to coat metallic layers with beryllium or to use beryllium as cementation means, for instance, for cast iron, in order to increase its hardness and resistance against corrosion. The high cost price of beryllium, however, inhibited its utilization in a wide scale.

My invention is based on the fact that it is far more advantageous to produce only a thin surface coating of beryllium alloy on the metal base on the points where the latter is attacked by abrasion or wearing. In accordance with my invention, metallic articles which are subjected to a surface abrasion are produced in such a manner that the articles are superficially coated with a thin layer of metals, such as nickel, cobalt, chromium, manganese, especially copper, whereupon they are subjected to a heat treatment with beryllium whereby care is to be taken that oxygen is excluded. Instead of pure beryllium, beryllium alloys or mixtures of beryllium with other suitable metals, such as copper, nickel, cobalt, chromium or manganese may be used.

In carrying out my invention, for instance, a steel tube or a bearing box of iron is copperplated or coated with any other suitable bearing metal, for instance, nickel, cobalt, chromium or manganese which after cementation with beryllium will resist to a stronger surface abrasion. Thereafter the interspace is filled with beryllium powder of a subdivided beryllium alloy, for instance of beryllium-copper alloy. I prefer to use cementation means of a great fineness, finer than 10.000 meshes or even more. Now the beryllium or beryllium alloy is brought into contact with the surface layer of the coating metal, at elevated temperture. As the beryllium has a special affinity to oxygen. mainly at elevated temperatures, the cementation is carried out either in vacuo or indifferent gases, as for instance, in an hydrogen or rare gas atmosphere. The cementation may be carried out advantageously in a resistance furnace or high frequency furnace, heated by hot gases to the necessary temperatures, i. e. to about 850° C. The diffusion of the beryllium may be enhanced by utilizatoin of hydraulic pressure

The advantages of my invention are obvious. As the metallic coating is made very thin, the time of cementation may be shortened considerably in comparison with the hitherto known processes. Moreover, by the sizing of the depth of the layer and by the content of beryllium in the cementation means as well as by the control of temperature during the cementation process, the quantity of beryllium to be diffused may be regulated in such a manner that the beryllium content in the cemented layer lies in the area which is especially suitable for bearing metals. Thus not only a very economic working will be secured, but at the same time a controlling of the beryllium concentration may avoid the forming of undesired phase, for instance, of brittle and coarsegrained intermetallic compounds in the cemented coating.

In accordance with my invention articles with a coating of bearing metals will be obtained with excellent properties as regards hardness, resistance against abrasion, self lubricating qualities and so on. After the cementation of the bearing metal coating, the articles may be subjected to an additional hardening by a suitable heat treatment. Articles which are coated with a copper beryllium layer may, for instance, be quenched at 700° C. and tempered again at temperatures of about 200 to 300° C.

My invention makes it possible to reduce the layer which is attacked by wearing, to a minimum depth, thereby using the beryllium only for its proper purpose, i. e. as hardening means. This opens the field for a wider utilization of beryllium in case hardening processes.

HANS BERNSTORFF

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ALIEN PROPERTY CUSTODIAN

CERAMIC COLORING MATERIALS AND PROCESS OF PREPARING THEM

Heinrich Diehl, Francfort-on-Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 15, 1940

Object of the co-pending application S. Nr. 130,217 of March 10th, 1937, is a process for the preparation of chromium-containing ceramic coloring materials by reacting solutions containing chromates, especially alkali chromates, with solutions of heavy metals and subsequent ignition of the resulting precipitates. The precipitation from the alkaline, mostly strong ammoniacal chromium containing solutions by means of nickel-, cobalt-, iron- or manganese-sulfate solutions is most suitably carried out at elevated temperature, for instance, 40 to 60° C. The resulting precipitates are filtered off, washed if preferred or necessary, dried and then subjected to calcination at a temperature of about 500 to 700° C., especially about 550 to 650° C.

It has proved advantageous to utilize chromate solutions which at least contain the quantities of ammonia which are necessary to bind the anions of the heavy metal salts with formation of ammonium salts and to precipitate the basic heavy metal chromates.

Further investigations have shown that the precipitates separate in such a finely dispersed state that no calcination is necessary.

In consequence thereof, the object of my new invention is a simplified modification of the co-pending application S. Nr. 130,217 of March 10th, 1937 in so far as the step of ignition is omitted and the precipitates only filtered off, washed and dried.

This process has proved to be most advantageous in the preparation of black ceramic coloring materials.

Example

To an aqueous solution of 11 kgrs. of manganese sulfate, 10 kgrs. copper sulfate, 2 kgrs. cobalt sulfate and 0.5 kgrs. nickel sulfate a solution of 6.8 kgrs. potassiumbichromate is added and the whole mixture heated to about 80 to 90° C. To this last solution about 4 kgrs. ammonia are added, either in gaseous form or in aqueous solution; the mixture is then cooled down under stirring. The precipitate which is at first dark brown becomes then nearly black. After cooling the precipitate is filtered off and rigorously dried, for instance at temperatures above 100° C.

HEINRICH DIEHL.

Published July 13, 1943

Serial No. 326,724

ALIEN PROPERTY CUSTODIAN

MAGNESIUM-BASE ALLOYS CONTAINING METALS OF THE CERIUM GROUP OF RARE EARTH, SUBSTANTIALLY FREE FROM CERIUM

Charles de Rohden, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

No Drawing. Application filed March 29, 1940

It has long been known that the addition of small percentages of cerium to magnesium gives rise to alloys possessing interesting mechanical properties, especially at relatively high temperatures (i. e. between 200 and 300° C.).

It is also known that cerium can be replaced in these alloys by the alloy of cerium rare earth metals commonly sold under the name of mischmetal, without altering their mechanical characteristics.

Mischmetal is obtained from Monazite sand, or other minerals rich in the cerium group of rare earths, without any separation of the metallic constituents or alteration in their relative proportions except for a slight increase in the cerium content, the remainder being composed of lanthanum, praseodymium, neodymium and samarium.

Experience has shown that at relatively high temperatures no other ultra-light alloys possess such advantageous mechanical characteristics as the alloys of magnesium with cerium or mischmetal. Unfortunately such alloys do not develop their full characteristics unless they contain over 2% of cerium or mischmetal, and much higher percentages may be needed in order to obtain optimum figures. It will easily be understood therefore that the high initial cost of cerium or mischmetal has had a very prejudicial effect on the industrial development of these alloys, which have so far never been placed on the commercial market.

The present invention consists in utilising for binary, ternary and higher magnesium-base alloys, instead of cerium or mischmetal, a mixture of lanthanum, neodymium, praseodynium together with small quantities of samarium and, should it be so desired, thorium and small quantities of the yttrium group of rare earth metals. This mixture or rare earth metals may if desired contain a small amount of cerium, or be almost completely free from the same, but in the event of appreciable quantities of cerium being present, the quantity should not exceed a few per cent of the total quantity of rare earth metals.

The present invention has for its basis the following facts. In the first place, magnesium base alloys with the cerium group of rare earth metals retain their excellent and very peculiar mechanical properties even if the cerium is completely or almost completely suppressed. In the second place, the inventor has made the surprising discovery that the presence of cerium in substantial amounts has the effect of lowering the resistance to corrosion of these alloys which are so highly interesting from the point of view of their mechanical characteristics.

To cite a particular instance, an alloy containing 9.5% of mischmetal, 2% of Mn and 0.4% of Ca shows a remarkable resistance to corrosion, as the following figures show. Two samples, weighing respectively 57 grs. 150 and 54 gr. 550 were immersed for 48 hours in sea-water. Each sample lost 0 gr. 580, representing a loss of 1.01% and 1.06% respectively. Two other samples of a similar alloy identical in form but in which the 9.5% of rare earth metals was substantially free from cerium, weighing respectively 64 grs. 250 and 50 grs. 800, were similarly immersed in sea-water for 48 hours. The loss of weight found in each case was 0 gr. 400, representing a loss respectively of 0.62% and 0.79%.

As a further example may be cited a sample of an alloy containing 6% mischmetal, 2% Mn and 0.4% Ca. This sample, which weighed 50 grs. 800 lost after 30 days immersion in sea-water 5.2% of its weight. Another sample of a similar alloy, identical in form, but in which the 6% of mischmetal was substantially free from cerium, lost under identical conditions 2.1% of its weight.

When such alloys do not contain manganese, the difference in susceptibility to corrosion is still more marked. Thus a sample of an alloy containing 9% of mischmetal and 0.4% of Ca lost after 48 hours immersion in sea-water 21.3% of its weight, whereas a similar alloy substantially free from cerium only lost 12.5%.

The present invention therefore has for its object and scope ultra light alloys of magnesium and rare earth metals substantially free from cerium.

When one desires to produce an alloy relatively high in rare earth metals, it is generally preferable to prepare separately the alloy containing the rare earth metals exempt from cerium. This may be done by any appropriate process. Thus for instance the cerium may be initially separated in aqueous solution from the other rare earth metals, these latter being then isolated by electrolysis with a mercury cathode, the resulting amalgam being distilled so as to recover the rare earth metals. Or again the rare earth metals deprived of substantially all their cerium may be transformed into the chlorides which are fused and electrolysed. This method presents considerable advantages if one wishes to prepare alloys containing a high rare earth metal content, since at the normal working temperatures (650–900° C.) there is but little difference in affinity for the halogens between magnesium and the

rare earth metals, and since at higher temperatures, where theoretically the reduction of rare earth-compounds by magnesium should prove easier, this reduction is rendered to a large extent impracticable by the volatility of magnesium.

If however one desires to obtain low percentage alloys, the above mentioned difficulties are less pronounced, and it is then possible to operate merely by displacing the metals of the rare earths from their halogen compounds, either by magnesium, with simultaneous formation of the desired alloy, or by means of calcium already incorporated in the magnesium or the rare earth metal alloy serving as a point of departure.

The following is a preferred method of executing the said invention, which is however given solely by way of example, and which must not be construed in any limitative spirit. Monazite sand is attacked by acid, and the cerium separated as CeO_2 by any known process. The rare earth mixture, substantially free from cerium, which may be for instance in the form of carbonates, is then converted into chlorides by treatment with hydrochloric acid, and the said chlorides are then dehydrated, fused and electrolysed in an iron crucible with a carbon anode. The resulting mischmetal free from cerium is then cast into ingots. The next step is to prepare an alloy with magnesium containing about 25% of rare earth metals, which in turn is used for preparing an alloy of magnesium containing 5% of rare earth metals substantially free from cerium, 1% of Mn and 0.2% of Ca, the remainder being Mg. The said alloy is then forged and used for pistons, propellor blades for aeroplanes etc.

The hereinbefore described invention permits of obtaining alloys of desired composition at a reasonable cost price, this being due to the separation of the cerium and its utilisation for other purposes. Moreover the resulting alloys have an increased resistance to corrosion.

The hereinbefore described invention also covers by way of new industrial products, magnesium-base alloys with rare earth metals substantially free from cerium, and also magnesium alloys containing higher percentages of the said cerium-free rare earth-metals which may serve as a starting point for the production of lower percentage alloys for commercial use.

CHARLES DE ROHDEN.

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ALIEN PROPERTY CUSTODIAN

COMPRESSOR-SUPERCHARGED CARBURATION DEVICES FOR INTERNAL COMBUSTION ENGINES

Marcel Louis Mennesson, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed April 5, 1940

This invention relates to compressor-supercharged carburation devices for internal combustion engines, of the kind wherein the compressor is located upstream of the carburettor for the general purpose of maintaining a constant pressure at the inlet of the carburettor by an automatic device which modifies the inlet or outlet section of the compressor, and has for its main object to utilise the properties of the compressor, thus located, to modify, in a simple manner, the adjustments of the carburation device and which are necessitated by the working conditions of the engine.

According to the main feature of the invention carburation devices of the above kind are so arranged that the value of the pressure at the inlet of the carburettor can be made to vary as a function of the working conditions of the engine, supplied by the carburation device.

In addition to this main feature the invention comprises further features, including the following:

A second feature consisting in arranging such carburation devices that the value of the pressure at the inlet of the carburettor can be reduced when only a fraction of the maximum power of the engine is utilised, in order to reduce the power absorbed by the compressor.

A third feature consisting in establishing a positive connection between the member by means of which the delivery of gases from the carburettor is regulated and the device which automatically determines the value of the pressure at the inlet of the carburettor, with a view to varying this value.

A fourth feature consisting in providing such a carburation device with a single automatic apparatus on which the delivery pressure of the compressor acts. This, for example, could be a single manometric capsule subjected to the pressure reigning at the outlet from the compressor or a deformable member (diaphragm) or movable member (piston) subjected to the difference of the pressures reigning respectively at the inlet and at the outlet of the compressor. This single automatic apparatus acts on regulating means adapted to effect the enrichment of the mixture when in the neighbourhood of the maximum power and also the automatic correction of the mixture as a function of the density of the air at the inlet of the carburettor.

A fifth feature consisting in making the single automatic apparatus, with which such carburation devices are provided, act on a distributor which, in turn, is adapted to control the above-mentioned regulating means through a relay, for example of the piston or diaphragm type, so that the single automatic apparatus simultaneously can serve several carburettors at the same time.

And a sixth feature—more especially relative to the case where the engine drives a propeller with automatically variable pitch—consisting in establishing a positive connection between the member which regulates the flow of the gases from the carburettor and the mechanism by which the variation of the pitch of the propeller is effected.

In order that the invention may be better understood, it will now be described with reference to the accompanying drawings, which are given by way of example only and in which:

Figs. 1 to 4 show, in diagrammatic vertical section, respectively four carburation devices constructed according to as many different embodiments of the invention.

With regard to the complete carburation device, it is provided, as known, with:

(1) A carburettor proper **1** which supplies the cylinders of the engine **2** with an air-fuel mixture through a conduit **3** and which comprises a butterfly-valve **4**, operated by a remote control constituted for example by a rod **5** and a hand lever **6** or the like, a nozzle system **7** fed by a constant level chamber **8** which always communicates by the passage **9** with the inlet **10** of the carburettor and which is connected by a conduit **11** to the nozzle system **7**,

(2) A compressor **12** with an inlet **13** and which is located upstream of the carburettor and connected, by a pipe **14**, to the inlet **10** of this latter,

(3) And automatic means adapted to maintain constant the pressure at the inlet **10** of the carburettor, these means being for example constituted by a shutter **15**, which is located by means of an automatic servo-control subjected to the action of the pressure reigning in the pipe **14** which connects the compressor **12** to the inlet **10** of the carburettor.

This servo-control is constituted, for example, by a piston **16** housed in a cylinder **17** and adapted to act on an arm **18** integral with the shutter **15**, the said piston being constantly acted upon by a spring **19** and being able to be subjected to the action of a fluid under pressure (for example oil under pressure) from an appropriate source connected by a supply conduit **20** to the inlet of a slide-valve distributor **21** or the like, the return conduit being designated by **22**. The distributor is controlled by a manometric capsule **23** which

is located in a chamber 24, permanently connected by a conduit 25 to the pipe 14, the free extremity of the capsule taking support on the base of the said chamber 24.

When the air shutter 15 occupies a determined angular position, the slide valve 21 closed the inlet of the cylinder 17 having the piston 16. If the pressure in the pipe 14 diminishes, the capsule 23 expands and moves the slide valve, to bring the cylinder 17 into communication with the oil-inlet conduit 20. This forces the piston 16 towards the left (Figs. 1 to 4) and further opens the shutter 15. The delivery of air drawn in by the compressor 12 increases and the pressure in the pipe 14 increases in consequence. This pressure, transmitted through the conduit 25 into the chamber 24, causes the contraction of the capsule 23 which moves the slide valve 21 in the opposite direction.

If the pressure at the outlet of the compressor or at the inlet 10 of the carburettor is that which is suitable, the slide valve returns to its closing position, shown on the drawings, and the air shutter 15 remains at its new position. If the pressure is or becomes too great, the slide valve 21 is moved until the cylinder 17 communicates with the return conduit 22 and the spring 19, in becoming preponderant, forces back the piston 16 which closed the shutter 15 further.

The pressure regulator, described above and which is known per se, can of course be replaced by any other similar device, with or without servo-control, so long as its operating member always acts to fix the value of the pressure reigning at the outlet of the compressor 12 or at the inlet 10 of the carburettor.

According to the invention the carburation device, such as that described above, is so arranged that the pressure reigning at the outlet of the compressor 12 or at the inlet 10 of the carburettor can be varied as a function of the working conditions of the engine 2 fed by this carburation device.

For this purpose there is inserted in the rod 5, which connects the butterfly-valve 4 of the carburettor to the control handle 6, an elastically deformable device such as a spring 26 and there is mounted on the said rod 5, at a suitable point, a cam 27 adapted to act on a bent lever 28, pivoted at a fixed point 29 and the free extremity of which acts on the point of support of the capsule 23 and against the action of a spring 30^1. By operating the hand lever 6 not only is the position of the butterfly-valve 4 of the carburettor modified but also the position of the cam 17 and in consequence that of the capsule 23 and slide valve 21 independently of the pressure which reigns in the pipe 14. The effect of this is to modify the constant value of the delivery pressure of the compressor, that is to say that which resigns at the inlet of the carburettor.

In addition, the carburation device is provided with means adapted to correct the richness of the mixture supplied to the engine by the conduit 3. For example and as shown in Fig. 1, the said means are constituted by a manometric capsule 31 which is housed in a chamber 32 which communicates by a conduit 33 with the pipe 14 which connects the compressor 12 to the inlet 10 of the carburettor. There is mounted on this capsule a rod 34, suitably guided in the axial direction and which is made integral with a needle valve 35 adapted to regulate the output of the fuel passing through the conduit 11 connecting the constant level chamber 8 to the nozzle system 7.

This device according to Fig. 1 functions in the following manner.

When the butterfly-valve 4 of the curburettor is wide open, the maximum power must be obtained from the engine 2. This maximum power is determined by the pressure which reigns in the conduit 3, which supplies the cylinders, this pressure being substantially equal to that reigning in the pipe 14 terminating in the inlet of the carburettor. This maximum pressure is determined by the designer according to the type of engine utilised. In order to obtain high powers, it is the general practice to utilise relatively high pressures and the maximum pressure is determined by the regulation of the inlet limiter, that is to say by the position of the manometric capsule 23.

If it is not desired to utilise the engine to the maximum of its power, it is necessary to move the butterfly-valve 4 of the carburettor towards its closing position, for example to its half-open position. The pressure in the supply conduit 3 then becomes very weak for the reason that the suction from the cylinders creates a certain depression between the engine and the butterfly-valve 4. But, on the other hand, the inlet limiter of the compressor always restores the same pressure in the pipe 14 as that which is required when the butterfly-valve is wide open. Now, this excess pressure may have several disadvantages; first of all the increase of pressure raises the temperature of the air rather considerably, which has an advantage in that freezing-up is avoided, but, on the other hand, if this temperature is too high, there is a risk of its causing an undue heating of the fuel in the carburettor.

On the other hand, the power absorbed by the compressor remains somewhat considerable since the degree of compression is itself rather high.

It is therefore of advantage, when only a fraction of the maximum power of the engine is utilised, to reduce the constant pressure which reigns at the inlet of the carburettor and in the pipe 14. For this purpose and when the pilot moves the hand lever towards the right (Fig. 1), that is in the closing direction of the butterfly-valve 4, the cam 27 causes the point of support 30 of the capsule 23 to descend towards the bottom (Fig. 1) and in consequence the pressure reigning in the pipe 14 stabilises itself at a lower value than when the butterfly-valve 4 is wide open.

In the case where it is desired to be able to effect an extreme-pressure for some minutes, especially and as usual for taking off, the spring 26 inserted in the control rod 5 is accommodated in a casing 36 which is mounted on the part of the rod 5 which is connected to the butterfly-valve 4. In this way the two parts of the said rod remain integral so long as the said casing has not come into contact with a fixed abutment 37 during the displacement of the hand lever 6 towards the left (Fig. 1). When the casing 36 reaches the abutment 37, the butterfly-valve 4 is wide open.

In order to obtain this extreme-pressure it is sufficient to change the value of the pressure in the pipe 14. To this end a supplementary stroke is provided for the hand lever 6 during which the position of the point of support 30 of the capsule 23 is modified through the intermediary of the cam 27. This supplementary stroke is made possible, without a displacement of the but-

terfly-valve 4 resulting therefrom, owing to the compression of the spring 26. It is possible to give the cam 27 a suitable profile for the most efficient utilisation of the engine 2 and the compressor 12.

At the same time as these variations of the conditions of use of the engine, it is necessary to change the composition of the mixture introduced into the engine. More especially, when in the neighbourhood of the maximum power of the engine, it is of advantage to increase the richness of the mixture and, when the extreme-pressure at the time of "taking-off" is brought into action, to subject this richness to a fresh augmentation.

As this variation of richness is a function of the charging, it was logical, hitherto, to have recourse to an automatic control by a capsule subjected to the pressure of the portion of the conduit 3 included between the butterfly-valve 4 and the cylinders. But when, according to the invention, the pressure at the inlet 10 of the carburettor is caused to vary, it is possible to connect the casing 32 containing the capsule 31 to the pipe 14 in which reigns the same pressure as at the inlet of the carburettor.

In effect, for running at low powers, a certain value of the pressure reigning in the pipe 14 is utilised, for running at maximum power a higher value of this pressure is utilised and for superpower running, a still higher value of this pressure is utilised.

In consequence, these three different values give three different lengths to this capsule 31 and the needle valve 35, coupled to this latter corrects, for example, the output of fuel passing in the conduit 11, so as to vary the richness of the air-fuel mixture in concordance with the desired condition of operation. The outline of the needle valve 35 is, naturally, fixed according to the variation of the richness it is desired to obtain.

Moreover, a time arrives, in consequence of the fall of pressure at the air inlet 13 of the compressor 12, when this compressor no longer can maintain the desired pressure in the pipe 14 although the shutter 15 remains open. From this moment, the pressure progressively diminishes in the pipe 14 in proportion as the density of the air diminishes. The above conditions exist for example in the case of an aeroplane rising to high altitude. Then the pressure which acts on the capsule 31 progressively diminishes and it is possible to utilise the same needle valve 35 to diminish the output of fuel to effect the automatic correction of the air-fuel mixture as a function of the density of the air at the inlet 10 of the carburettor.

In consequence, by establishing a positive control between the hand lever or the like and the butterfly-valve 4 of the carburettor 1 and by acting through the intermediary of this positive control on the value of the pressure at the inlet 10 of the carburettor, there is therefore the possibility of effecting the corrections of the mixture necessary to the efficient operation of the carburettor under all conditions, and this by means of a single manometric capsule 31 subjected to the pressure reigning at the inlet of the carburettor.

For the example shown in Fig. 2, recourse is had to the carburation device similar to that described above but for which the power-enrichment and correction apparatus acts, not by means of a needle valve 35 on the output of the fuel, but on the delivery of ventilation air. For this purpose the ventilation air is taken by a piping 38 from the air inlet of the carburettor, or—what comes to the same thing—from the delivery pipe 14 of the compressor. The delivery of this air is regulated by a valve 39 of suitable profile, connected to the capsule 31 and located in a calibrated orifice 40 provided in a chamber 41 into which opens the piping 38 and which is connected to the nozzle system 7 by a conduit 42 a desired length of which is engaged in the said system.

It is known, when the delivery of this ventilation air is reduced, that the effective suction on the fuel-calibrator increases and, in consequence, that the mixture is enriched. If the delivery of this air is increased, the mixture on the contrary becomes impoverished. The result sought for is obtained by actuating the needle valve 39 by the capsule 31 since this latter is always subjected to the action of the pressure reigning in the delivery pipe 14 of the compressor.

For the example shown in Fig 3, recourse is had to a carburation device analogous to that of Fig. 1 but for which there is utilised not a manometric capsule 31 for actuating the needle valve 35 but a diaphragm 53 loaded by a spring and dividing a chamber 44 into two compartments 45 and 46. The compartment 45 is made to communicate, through the conduit 33, with the delivery pipe 14 of the compressor and the compartment 46, by the conduit 47, with the air inlet 13 of the compressor 12 at a point which is located between the shutter 15 and the rotor of the compressor.

It is obvious that the diaphragm 43 acts exactly like the capsule. In effect, the pressure in the chamber 45 is always the same. It is determined by the admission-limiter of the compressor. The pressure in the chamber 46 depends, for a given working condition, upon the opening of the shutter 15. This opening is all the greater as the necessary flow of air is greater and, in consequence, the butterfly-valve 4 is more fully open. In consequence the movement of the diaphragm 42 and, consequently, of the needle valve 35, varies in a manner similar to the opening of the butterfly-valve 4. It is therefore possible to effect, with the aid of this diaphragm 42, the operations of enrichment at full powers and of correction when the pressure in the delivery pipe 14 becomes too feeble.

For the example shown in Fig. 4 recourse is had to a modification of the carburation device of Fig. 1, in that the manometric capsule 31, still subjected to the pressure reigning in the delivery pipe 14, no longer directly actuates the enrichment and correction devices but actuates a distributor 48, for example of the slide valve type, adapted to slide in a chamber 49 one extremity of which opens to the atmosphere by an orifice 50 and the other extremity of which is connected by a conduit 51 to a source of pressure, for example to the delivery pipe 14 of the compressor.

A two-stage power-enrichment system has been shown; this system comprises a piston 52 loaded by a spring 53 and of which the surface situated towards the spring communicates with the atmosphere by an orifice 54. This piston acts on a needle valve 55 adapted more or less to obturate a passage 56 which opens into the delivery pipe 14 and which permits of assuring, by a conduit 57, the ventilation of the main nozzle system 7 in the same fashion as the conduit 42 of Fig. 2. When the needle valve 55 obturates the passage 56, a certain enrichment of the mixture is obtained. When a second piston 58, identical

with the first 52, actuates, in its turn, a needle valve 59 in order to obturate a corresponding passage 60, another enrichment is effected.

The face of the piston 52 opposed to that where the spring 53 is located, communicates by a piping 61 with the chamber 49 of the distributor 48 and the apparatus acts in the following manner.

When the engine is utilised at a fraction of its maximum power, the pressure in the delivery pipe 14 is not at its maximum value as has been explained above, and the slide valve 48 occupies such a position that the pipe 61 communicates with the air through the orifice 50.

If the opening of the butterfly-valve 4 is increased, the cam 27 is displaced at the same time by the hand lever 6, which causes the rise of the pressure in the delivery pipe 14. The capsule 31 contracts and the slide valve 48 first of all obturates the piping 61 so as subsequently to put it into communication with the pipe 14 by the conduit 51. At this moment the pressure in the pipe 14 is transmitted behind the piston 52 and the force created compresses the spring 53. The needle valve 55 then obturates the passage 56 and a certain enrichment takes place.

If the pressure in the pipe 14 is further augmented, for the taking-off of the aeroplane for example, the slide valve 48 operates in the same way with the piping 62 which opens into the chamber of the second piston 58 and the needle valve 59, integral with this needle valve, obturates the other passage 60 for the ventilation air, thus producing a second enrichment stage.

Finally, if the pressure in the pipe 14 falls below the minimum value provided for, in consequence of the fall of the density of the air at the inlet 13 of the compressor, the slide valve 48 acts in the same way, by a conduit 63, on a piston 64 united with the needle valve 35 and accommodated in a chamber 65 the base of which is pierced by an orifice 66 to the atmosphere. The two faces of the piston 64 are thus put into communication with the atmosphere. As one of the faces is loaded by a spring 67, the piston 64 and the needle valve 35 move towards the right of Fig. 4, to reduce the flow of fuel.

The advantage is thus obtained that a piping (61 or 62) can intervene in the operation of a piston, such as 52, for several carburettors at the same time and, when the engine is equipped with two, or a greater number of carburettors, a single capsule, such as 31, permits of effecting the enrichment or the correction for all the carburettors at the same time, a condition necessary for preserving an efficient operation of the engine.

In all the cases considered above, the pressure in the pipe 14 has, for the circumstances considered, a fixed value. It is therefore obvious that the supply to the engine for a given condition depends solely upon the position of the butterfly-valve 4, that is to say upon the position of the hand lever 6 and, in the case where the engine 2 comprises a propeller with automatic variable pitch, for which the operation of the blades 71 depends upon a regulating device 70 of any appropriate type (the details of which have not been shown in Figs. 1 to 4), it is possible, according to the invention, to control the operating member 69 of this regulator through the intermediary of a positive connection, such as a rod 68, located between the said member 69 and the rod 5 which acts on the butterfly-valve 4 of the carburettor. The effect of this connection between the respective operations of the control members 4 and 69 therefore is that for the same condition of operation of the engine 2 there always corresponds the same power and reciprocally.

The invention is not limited to the precise forms or details of construction described, as these may be varied to suit particular cases.

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JULY 13, 1943.

BY A. P. C.

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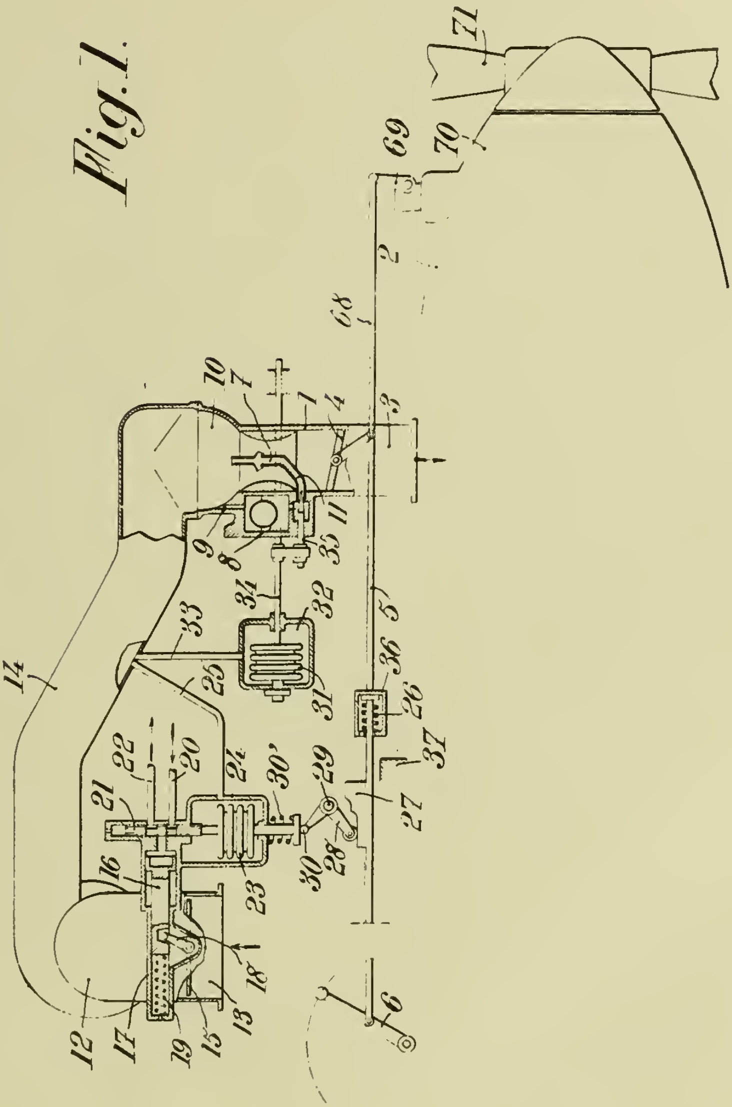
COMPRESSOR-SUPERCHARGED CARBURATION DEVICES FOR INTERNAL COMBUSTION ENGINES

Filed April 5, 1940

Serial No. 328,115

4 Sheets-Sheet 1

Fig. 1.



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4 Sheets-Sheet 2

Fig. 2.

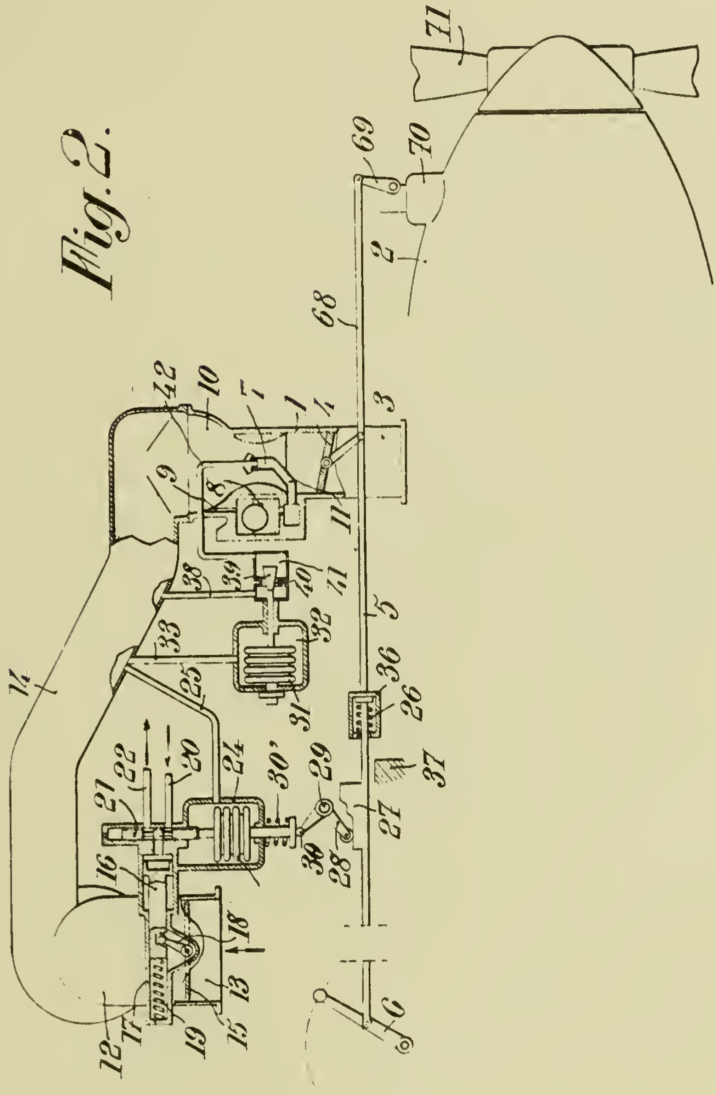

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Fig. 3.

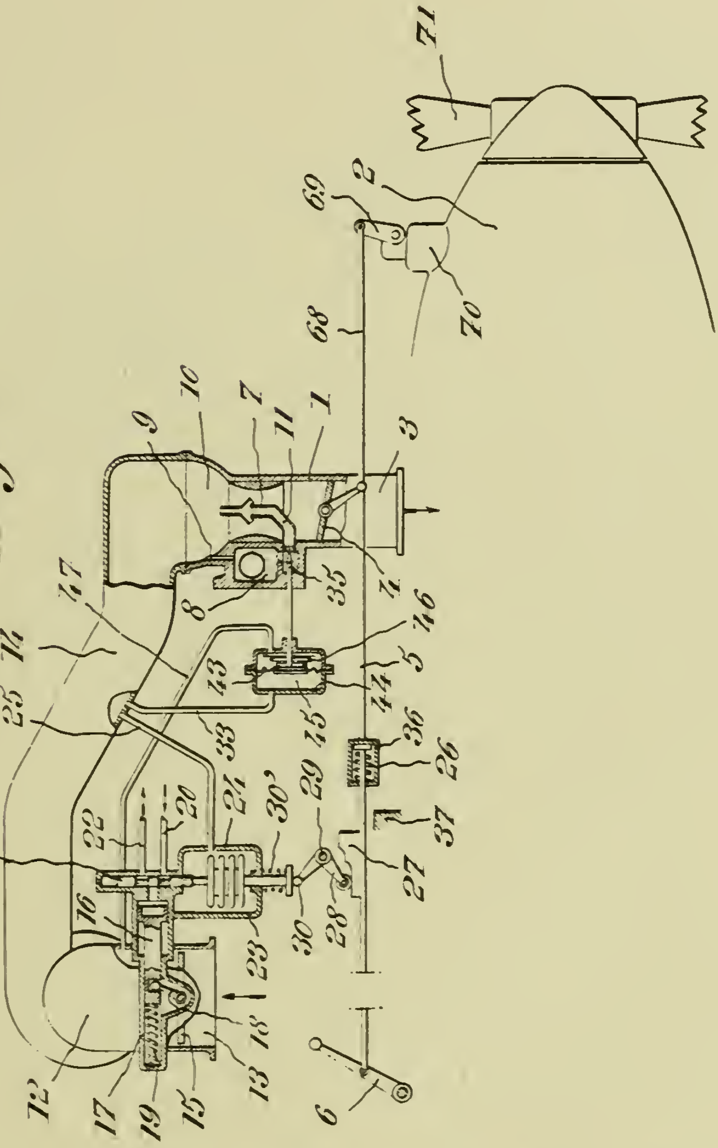

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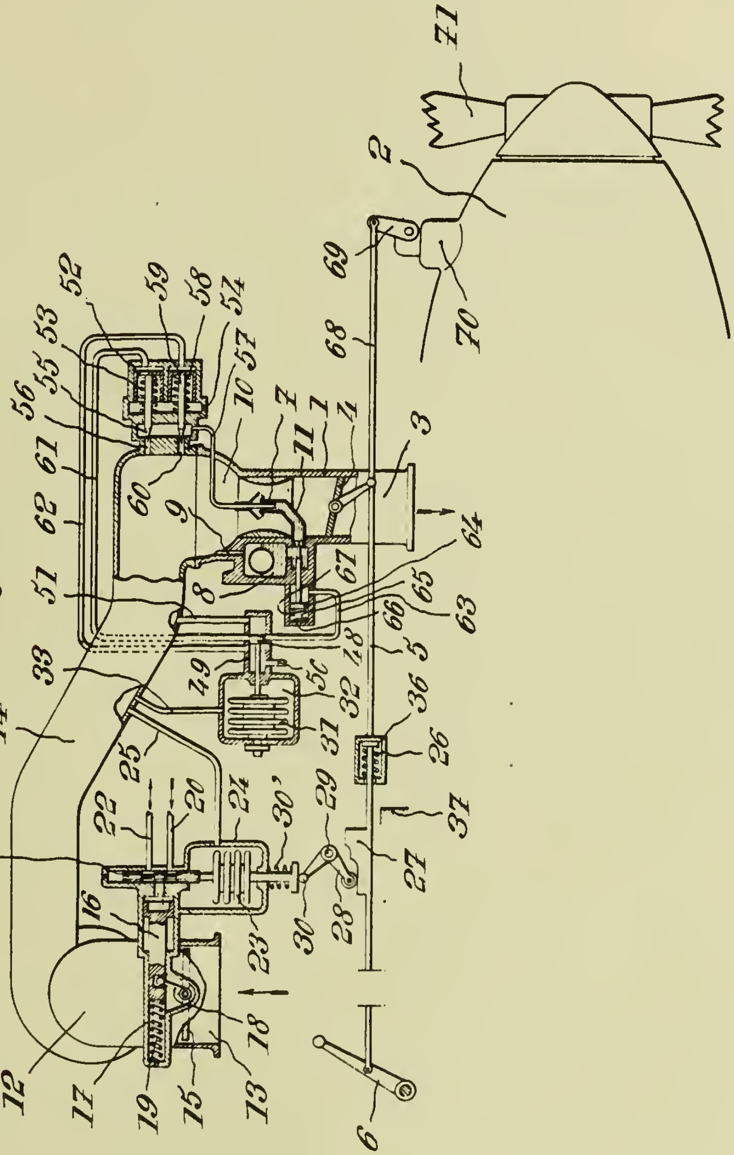
Fig. 4.



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Published July 13, 1943 Serial No. 331,456

ALIEN PROPERTY CUSTODIAN

ELECTROPLATING BATHS FOR THE ELECTRODEPOSITION OF BRASS, COPPER, ZINC, CADMIUM

Robert Weiner, Frankfurt a. M., Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 24, 1940

This invention relates to the electrode-position of bright coatings of brass, copper, zinc and cadmium as well as to a process for the production of cyanide containing electroplating baths. More particularly, the invention is directed to the improvement of the character of the bright deposits.

Heretofore various substances, such as turkey red oil, colloids, for instance, glue, gelatin and other organic substances, such as thiourea, polyvinyl alcohol and the like have been used as brighteners in cyanide containing electroplating baths. These substances were added in more or less large amounts to the baths and as far as possible uniformly distributed therein. It was, however, neither possible to obtain satisfactory or permanent bright deposits with these additions nor thicker electrodeposits of brass with a permanent brightness. Thin bright coatings were obtainable after short electroplating but these layers became quickly dull again.

An object of this invention is the electrodeposition of brass, copper, zinc, cadmium from alkaline cyanide containing plating baths. It is further object of my invention to provide platings baths from which bright mirror like deposits of these metals may be obtained.

The objects of my invention are attained by effecting a modification of cyanide baths through the addition of polymerization products of an unsaturated ketone or aldehyde, for instance, of acroleine or of ethyl iso propenyl ketone to such baths.

In carrying out my invention liquid, for instance, viscous, as well as higher polymerized solid polymerisates may be used. Soluble polymerisates may be put immediately into the plating baths. The addition of insoluble polymerisates may be carried out in different ways. The polymerisates may be dissolved in a small amount of sodium hydroxide solution and the resulting solution added to the cyanide bath. It is also possible to emulgate the insoluble polymerisate with turkey red oil or other emulgators, for instance, products derived from albumin, commercially known by the trademarks "Egalisal" or "Lamepon" and adding the emulsions to the cyanide plating bath. Another modification of my invention is attained by dissolving the polymerisates in organic solvents, such as alcohol or acetone and then adding these solutions to the baths. As some solvents, for instance, acetone influence the effect of the plating baths, I proceed, for instance, in such manner that the polymerisates are first dissolved in organic solvents and then precipitated with water. The polymerisates are thereby transformed into extraordinarily fine division and may therefore also be added in an undissolved state.

Finally, I may also proceed in such manner that monomer or only partially polymerized unsaturated ketones or aldehydes are added to the plating baths, which substances are generally more easily soluble than their higher polymerized derivatives and tend to polymerize themselves in the plating baths.

The polymerisates are utilized in amounts between 0,1 to 1 g.

Now it was found that the favorable effect of the polymerisates with respect to the brightness of the deposited metals may be enhanced by the simultaneous presence of other brightening addition products. It has proved especially advantageous to use for this purpose soluble salts of other metals, such as aluminum, titanium, chromium, molybdenum, tungsten, manganese, iron, cobalt, nickel. Utilization of these combined coatings yields mirror like surfaces. Thus a better and more lustrous brightness than by simple polishing may be obtained. This is due to the fact that with a buffing treatment always remain very fine furrows whilst by electrodeposition a homogeneous surface with a more beautiful brightness is formed.

Examples

1

	Grams
Potassium zinc cyanide	40
Potassium copper cyanide	40
Potassium cyanide	2
Potassium carbonate	1

are dissolved in one liter of water whereupon 2 grs. potassium nickel cyanide and 0,1 to 1 g. of a polymerisation product of methyl isopropenyl ketone in 3 cc. concentrated soda lye are added. Current density 0,3 amp./qdm. After electrodeposition of one hour duration or more, mirror like brass deposits were obtained.

2

	Grams
Potassium cadmium cyanide	110
Potassium cyanide	40
Caustic soda solution	30
Potassium nickel cyanide	2

are dissolved in 1 liter water and 12 grs. turkey red oil and 0,1 to 1 g. of a polymerisation product of methyl isopropenyl ketone added. With a current density of 2–4 amp/qdm in the still bath of cadmium and 4 to 6 amp/dqm in the agitated bath mirror like depositions are easily obtained.

ROBERT WEINER.

Published July 13, 1943 Serial No. 347,759

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF BLEACHED CELLULOSE

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No Drawing. Application filed July 26, 1940

In my co-pending application Serial No. 303,913 a process for the bleaching of cellulose by a combined treatment with hypochlorite and peroxide is disclosed, consisting in first bleaching with peroxide and following treatment with hypochlorite. This method may be carried out either at a simple bleaching treatment with hypochlorite even when performed in several steps or at the so-called three step bleaching method. In the last mentioned process the lignine is first treated with elementary chlorine in order to transform the incrustated lignine into chlorinated lignine which will then be dissolved by means of an alkaline treatment, thereafter rinsed whereupon the final treatment either with hypochlorite alone or with peroxide and subsequent hypochlorite treatment as disclosed in the co-pending application Serial No. 303,913 takes place.

Now I have made the surprising observation that a further simplification of this process may be attained in such manner that the crude cellulose treated with elementary chlorine with or without intermediary rinsing may directly be treated with peroxide thereby replacing the otherwise usual alkalinization and then finished with a hypochlorite treatment. According to the elimination of one operation step, i. e. the alkalinization, expenses, steam and water will be saved to a certain extent. In this respect it was not to be foreseen that no harmful decomposition of the peroxide used in the second operation step would occur. On the contrary, it could be expected that the chlorinated incrustation would exert a destructive effect on the peroxide thereby causing a decrease in the bleaching effect or an increase in the quantity of peroxide used. In fact, however, it was found that these apprehensions did not prove true; in many cases the by-products originating from the chlorination exert even a stabilizing effect on the peroxide. According to my invention it is therefore possible to add the peroxide immediately after the chlorination process. Sometimes it may be advisable to wholly or partly separate the chlorine solution from the cellulose by sucking off, thickening or the like, and afterwards adding the peroxide. In special cases, for instance, with cellulose with higher chlorine consumption it is expedient to rinse already during or immediately after the chlorination. But, according to my invention, no special intermediary alkaline treatment is necessary.

As acid substances will be formed during the chlorination and especially during the immedidiately following treatment with peroxide I have found it advantageous to take care that the alkalinity of the bath solution is maintained whilst the peroxide is added. In many cases the alkali content of the sodium peroxide alone is sufficient. Moreover, additional quantities of sodium hydroxide, sodium carbonate, potassium carbonate, calcium hydroxide may be used to secure the necessary alkalinity of the bleaching bath. It is, however, advantageous to keep the alkaline concentration at a medium level, for instance, about 5% or less, preferably less than 2%, calculated as sodium hydroxide based on the textile material. In many cases it has proved expedient to keep the alkali content as low as even possible. The amount of peroxide used in this operation step is calculated in such manner that the peroxide is consumed in nearly one to two hours at temperatures up to about 60° C.

Instead of sodium peroxide other peroxygen compounds such as sodium perborate, sodium percarbonate, sodium perpyrophosphate or hydrogen peroxide itself may be utilized. If desired, special stabilizers such as, for instance, alkali or earth alkali silicates may be added to the peroxide solutions but in many cases this is not necessary.

The treatment with peroxides is followed by a treatment with hypochlorite whereby, according to my invention, either sodium hypochorite, potassium hypochlorite or bleaching powder are employed. The hypochlorite solution may immediately be added, expediently after an intermediary rinsing. If, however, the peroxide bleaching process is carried out at higher temperatures the bath may be cooled or rinsed down to a temperature of about 35° C., whereupon the hypochlorite will be added. The bleaching with hypochlorite is continued until the desired degree of whiteness is obtained whereupon the solution is acidified and finally rinsed.

EMIL SCHELLER.

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ALIEN PROPERTY CUSTODIAN

DENTURES

Erich Czapp, Frankfurt a. m., and Max Burkhardt and Alfred Jedele, Hanau a. m., Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 3, 1940

Our invention relates to a process for the manufacture of dentures such as protheses, crowns, bridges, plates made of artificial resins, especially polymersates, conjoint polymersates, polymerisation mixtures, particularly of the acrylic, and methacrylic acid, their esters or other derivatives. More especially, our invention relates to the production of dentures from artificial resins to which short fibrous, not swellable inorganic and/or organic material is added before the artificial resins are formed and solidified. The fibrous material shows nearly the same optical qualities, i. e. the same or a similar refractivity coefficient as the utilized mass of artificial resin.

Expediently, fibres are used with a strength of about 1–3 μ and a length of about 1–3 mm. Very good results were obtained with glass and/or quartz fibres which were incorporated in a mixture of monomeric or only partially polymerized and polymeric methacrylic acid ester, for instance, methyl ester. Care is to be taken that no formation of lumps or feltening occurs during the incorporation of the fibrous material in the artificial resin, for instance, the polymeric powder or the monomeric liquid. This is done by careful election of the respective quantities.

Instead of glass fibres or other inorganic thread material, for example, finely divided slag wool, also an organic fibre material, for instance, polycondensation products of the polymethylenediamines with dicarbonic acids, may be used.

In adding such fibrous material of inorganic and/or organic origin a final product is obtained which contrary to the hitherto made observations in the production of articles made of artificial resins with filling materials such as cotton fibre material, cellulose wool, asbestos and the like, is transparent and shows in addition an increased impact, breaking and bending strength which renders the material specially suitable for the production of dentures.

The products according to our invention may be colored by adding suitable pigments whereby natural color transitions may also be attained, for instance, in such manner that differently colored layers are piled and combined in a suitable manner, for instance, through pressure and/or heat. In accordance with our invention excellent and natural color effects may be obtained if in the mass colored, clearly translucent and/or cloudy fibrous material in suitable quantities is added to the product.

If artificial teeth are manufactured according to our invention inorganic spherical glass or quartz powder material in a quantity up to 40 to 50% may be added to the fibrous material in order to ascertain an increased abrasion strength. Thereby we prefer to use the fine spherical additional material only in the surface layer, especially in the masticating surface of the dentures which may prevent cases of stomatitis.

The diameter of the spherical quartz or glass is 1–100 μ, preferably 10 μ.

We prefer to embed the spherical glass material in the surface of the artificial resin in such a manner that the border of each spherule closes with the resin surface. If such artificial tooth is used, the resin surface because of its lesser strength of abrasion against the glass is only slightly worn off by the pressure of the antagonist on the base as this pressure is exerted not only on the resinous part but also always on a group of spherical calottes. This, of course, distributes the strength of pressure on a large area. According to our invention the attrition strength of glass itself is thereby applied to the masticating surface of the tooth which is therefore not subjected to an abrasive effect as the case would be if common glass powder were used.

A further advantage of our invention lies in the fact that during the polymerization a relatively great amount of heat is liberated in a relatively short time. In consequence to a local accumulation of heat this is leading to an overheating of the material whereby the monomeric product will partially be evaporated and the formation of undesired bubbles resulting from contraction of the material will be increased. Hitherto the formation of bubbles was, if possible, avoided by substantially decreasing the monomeric part of the mixture. But this is only possible to a certain extent as the mixture will then become too dry and can not be worked.

Now it was found that owing to the addition of short fibrous material the monomeric part may be substantially decreased without endangering the workability of the mixture or the qualities of the final product. A disadvantageous accumulation of heat is thereby also avoided and the polymerisation itself directed in such manner that the monomeric product is only gradually polymerized and the formation of bubbles inhibited. The formation of bubbles may also be prevented by application of pressure on the mass to be polymerized.

In certain cases a liquid polymerisable substance together with the above mentioned fibrous material may be used instead of a mixture of solid polymerisate and a liquid polymerisable substance.

ERICH CZAPP.
MAX BURKHARDT.
ALFRED JEDELE.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF CHROMIUM CONTAINING COLORING AGENTS FOR GLAZES, ENAMELS AND THE LIKE

Heinrich Diehl, Frankfurt A. M., Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 3, 1940

This invention relates to a method for preparing chromium containing pigments. More specifically, it relates to pigments containing soluble chromium compounds and other substances which by double conversion are able to form insoluble or lowly soluble chromium compounds. As additional substances I mean particularly carbonates, phosphates, sulfates, oxalates and other salts of the metals calcium, barium, zinc, lead, copper, silver.

In the hitherto known processes chromium compounds, for instance, chromium oxide, potassium bichromate, chromite and the like as well as other compounds, for instance, iron oxide, zinc oxide, silica, feldspur, calcium fluoride were used for the preparation of ceramic coloring agents for enamels, glazes, underglazes or the like. Now it was observed that the thus prepared colors contained substances which, when washed and dissolved were capable to exert a more or less harmful influence on the human skin. Furthermore, these coloring pigments have sometimes the disadvantage that the soluble constituents of the pigments tend to effluence on the base material whereby the formation of clear outlines after firing will be prevented.

These disadvantages are due to the fact that the chromium containing coloring agents, prepared according to the hitherto known processes generally contain small quantities of soluble chromium compounds, for instance, sodium chromate.

My invention has for an object the preparation of improved coloring agents in which the soluble chromium compounds are converted into insoluble or lowly soluble chromium compounds. Preferably, the insoluble or lowly soluble chromium compounds are produced by double conversion through addition of suitable substances, thereby resulting in, for example, insoluble chromates. Such suitable substances are, for instance, carbonates, phosphates, sulfates, oxalates and other salts of the metals calcium, barium, zinc, lead, copper, silver and the like.

In general, small quantities of the above mentioned metal salts, for instance, about 0.01 to 5%, preferably about 0.1 to 1%, will be sufficient. In special cases the quantities may be increased.

The additional substances may be given to the mill. They may be added to calcined or uncalcined coloring agents or mixtures therefrom. If desired, the additional substances may also be added to the glazes or enamels before or during their mixing with the pigments or pigment mixtures.

The coloring agents according to my invention are entirely harmless for the human skin. In applying these coloring agents or their mixtures, for example, in the form of suspensions on the base material perfectly clear outlines and borders will be obtained after the firing process.

Examples

(1) To a mixture of—

	Per cent
Fe_2O_3	20
Cr_2O_3	19
ZnO	49

after calcination at 1280° C., 0.5% of barium carbonate are added to the mill. A coloring agent is obtained which is entirely free from soluble chromates.

(2) To a mixture of—

	Per cent
$K_2Cr_2O_7$	37,6
SiO_2	20,8
Feldspar	20,8
CaF_2	20,8

after calcinating at 950° C., 0.7% of lead carbonate is added. The mixture results in a Victoria Green which after washing gives perfectly clear aqueous wastes free from chromate.

(3) To a mixture of—

	Per cent
Porcelain mass	75
Chrom iron ore	25

1% of calcium sulfate is added. This mixture may be used without calcination and contains no soluble alkali chromate.

HEINRICH DIEHL.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR PREPARING MEANS FOR WASHING, WETTING AND EMULSIFYING

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No Drawing. Application filed December 10, 1940

For the preparation of sulphonates the conversion of higher aliphatic alcohols by sulphuric acid is already known. The esters of sulphuric acid obtained thereby are usefully applied in industry as washing-, wetting-, dispersing-, emulsifying- and purifying means. The higher sulphonic acids which, for example, contain more than 8 carbon atoms per molecule show extremely good properties.

The sulphonation of these fatty alcohols presents great technical difficulties, which are mainly due to the nature of the starting material used. As such, until now alcohol mixtures have been used which are present, for example, in wool fat, soja oil, coco nut butter, carnauba wax, or suitable fats and fatty oils, or which can easily be obtained from them by known processcs. Besides injurious carboxyl-rest groups, such raw materials always contain undesirable protein compounds, glucosides, ferments and impurities of unknown composition.

It has already been proposed that purified fatty alcohols should be sulphonated. Apart from the wastage and costs involved it is not possible, even by careful and much repeated purifying, to remove the injurious foreign substances, so that the same fundamental difficulties arise as are observed in the treatment of the unpurified substances. This applies especially to the purifying methods commonly used for higher alcohols, which methods always affect the sulphonation unfavourably. For these reasons up to the present it is generally considered that the difficulties are primarily imputable to the sulphonating process itself, and only secondarily to the raw material.

It has been found that very valuable sulpho-compounds with high yields are obtainable when synthetic products, and not vegetable raw materials, are used as basic substances, namely alcohols which by addition of carbon monoxide and hydrogen have been prepared from hydrocarbons with alkene double-bindings.

The result obtainable with the process according to the invention is especially good when the alkene hydrocarbons obtained in the carbon oxide hydrogenation are used which, on account of their special structure and high purity, are especially suited for the sulphonation. When using these products, on the one hand the sulphonation process is considerably facilitated and on the other, important improvements with respect to yield and washing properties are obtained.

The alcohols prepared from the alkene hydrocarbons of the carbon oxide hydrogenation by further addition of carbon oxide and hydrogen are completely free from fermentative substances, and contain no carboxyl-rest groups, nor other injurious substances. They form an easily obtainable basic substance for preparing the technically very important sulphonic acids, since the gasifying products of coal that are available everywhere serve as raw material.

It is true that it has already been proposed to prepare artificial washing substances from "synthols", that is to say products resulting from the conversion of carbon oxide and hydrogen obtained at a fairly high temperature and at high pressure. But this suggestion has not led to a practical solution of the important problem of procuring washing substances; since the synthol contains no suitable higher alcohols, or only insignificant amounts thereof; and because this synthesis also produces injurious secondary products.

For the preparation of alcohols applicable in accordance with the invention, hydrocarbons containing an alkene double binding which are especially suitable products of the carbon oxide hydrogenation, are converted by catalysis with carbon oxide and hydrogen. For example one uses a mixture of hydrocarbons containing large quantities of C_{11}-alkenes (undecene) and yielding a mixture of laurine alcohols as final product.

As examples of catalysers, finely divided metals of the iron group can be mentioned especially iron, cobalt or nickel; preferably mixed with activating substances such as, for example, thorium oxide, magnesium oxide, or aluminium oxide. The conversion is performed at temperatures between 50° C (122° F) and 200° C (392° F) under high pressure, and preferably under very high pressure. It is also possible to proceed in two stages: first adding the carbon oxide and hydrogen to the alkene double binding until the formation of ketones or aldehydes takes place; and then reducing to the corresponding alcohol by a convenient method.

These alcohols obtained from alkenes in one or two stages are now converted with sulphuric acid in the usual way at temperatures between 10° C (50° F) and 50° C (122° F), when necessary by adding contact or diluting substances. Higher conversion temperatures, for example 180° C (356° F), may also be used. The sulphonation-compounds are separated from the reaction mixture in the usual way.

For the preparation of sulphonates sulphuric acid may be combined either with alkenes or with

alcohols. In the working up of alcohols it is not only possible to use alcohols prepared in any way one chooses, but also those obtained from alkenes by the addition of watergas as described in the above. The pre-treatment of the alkenes with watergas is not without purpose; it makes the preparation of synthetic sulphonates very successful and economic.

In the first place a considerable increase in yield is obtained.

In consequence of unavoidable by-reactions the direct addition of sulphuric acid to alkene hydrocarbon mixtures gives a yield of not more than about 50%. On the other hand, by the addition of watergas the weight of the alkene to be treated is increased corresponding to the CO/H_2-group. In this way, with an average of C_{15} per molecule, an alcohol-yield is obtained, for instance, of about 115% by weight calculated on the starting alkene. The sulphonation of such addition products then takes place with an almost quantitative yield. As compared with the alkene sulphonation, the yield is consequently at least redoubled.

By the direct addition of sulphuric acid, sulphuric acid esters of secondary alcohols are exclusively obtained from alkenes (see Karrer, Lehrbuch der organischen Chemie, 1936 pg. 56–57).

On the other hand, by the previous addition of watergas only primary alcohols are obtained. With regard to the obtainable capacity for washing- and wetting, experience proves that the sulphuric acid esters of primary alcohols are much more valuable than those of the secondary alcohols.

Especially favourable properties are obtained by reason of the special molecule structure and molecule mixture of the sulphonates prepared from alkenes to which watergas has been previously added.

Through the oxidation of paraffines one obtains e. g. fatty acids, and from their reduction alcohols which without exception, contain normal carbon chains. Ramifications present in the primary product are almost completely removed by the oxidation (see e. g. Wietzel, Angew. Chemie, Vol. 51 (1938), pg. 532; Jantzen, Reinheimer and Asche, Fette und Seifen, 1938, pg. 615). The dieseloil of the carbon oxide hydrogenation which is a satisfactory basic substance for the synthesis of aliphatic alcohols, contains, for example, more than 60% isoparaffines with ramified chains (see e. g. Koch und Ibing, Ges. Abhandl.z. Kenntnis der Kohle, Vol. 12, pg. 428). Only by previous addition of carbon oxide and hydrogen to the alkene double bindings alcohols of ramified constitution can be obtained therefrom. Hereby not only the ramifications present in the basic hydrocarbon remain unchanged, but by the addition of watergas new ramifications are produced as well, since the carbon oxide as a rule generally enters into the molecule as a side-chain.

Sulphonates prepared from alcohols with ramified chains have a much better washing-capacity than those prepared from straight chain alcohols. It is also known that sulphonating products with ramified chains have a very high capillary activity (see Chwalla, Textilhilfsmittel, 1939, pg. 169; French patentletters 805,706 and 806,112). These properties are principally determined by the greatly increased solubility compared with that of the straight chain sulphonates. Sulphonating products which, according to the invention, have been prepared from alkenes after a previous addition of watergas show these advantages to considerable effect.

Finally it may be observed that up to the present only sulphonates of even numbers have generally been prepared, for example with C_{12}, C_{14}, C_{16} etc.-molecules, while alcohols of odd numbers are technically very difficult to obtain. However, the washing capacity of single sulphonates is much smaller than that of sulphonate mixtures. By addition of watergas to alkene double bindings a completely graded series of all molecule sizes, for example from C_{10} up to C_{20} can be prepared, the odd number carbon chains included. In this way sulphonate mixtures with maximum capacity are obtained, such as have not been available up to date.

OTTO ROELEN.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF BORON FREE ENAMELS, GLAZES AND THE LIKE

Walter Kerstan, Frankfurt A. M./Praunheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 12, 1940

My invention relates to the manufacture of enamels, glazes and the like which are entirely free of boric acid or other boron compounds. More particularly, the invention relates to the manufacture of enamels, glazes and the like which contain an alkali-earth alkali double carbonate, preferably calcium-sodium double carbonate instead of the hitherto used boron compounds.

Heretofore enamel coatings which were applied to steel sheet or cast iron bases were made from mixtures of feldspar, quartz, soda, borax, saltpeter, kryolith, fluor spar and the like with an addition of colored or white pigments. A more or less great amount of fluxes was necessary to fire the enamels at a temperature of 700 to 850° C. The most common and mostly used fluxes are boric acid or its compounds, preferably borax. By adding boric acid or its compounds to the enamel batch it is possible to produce an enamel with a low fusion point and to adapt the extension of the enamel fluxes to the respective metallic bases. This addition of boric acid or boron compounds renders the enamel also more valuable with respect to its physical properties, such as increased thermal resistance, brightness of surface, impact strength and the like.

In spite of numerous investigations it was heretofore nearly impossible to produce commercially utilizable boron free enamels with properties equal to those of boron containing enamels as no other flux possesses the qualities of boron compounds.

According to my invention a way is shown for the manufacture of enamels without the addition of boric acid or boron compounds. The new enamels have at least the same good properties as the boron containing enamels, if not even better qualities.

According to my invention an alkali-earth alkali double carbonate, preferably calcium-sodium double carbonate, in quantities of 10 to 50, preferably 30 to 40%, is added to the enamel composition.

It is known that alkali carbonates and earth alkali carbonates form double salts. Thus, for instance, soda and calcium carbonate yield to the carbonate (Na_2Ca—$(CO_3)_2$) which melts at 813° C., about 50° C. below the fusion point of pure soda. The potassium-calcium double carbonate is melting at an even lower temperature. I have found that an addition of such double carbonates to enamels exerts a strongly liquefying effect on these enamels.

This action was surprising although it was a well known fact that small quantities of earth alkali compounds such as calcium carbonate were used besides soda in the production of enamel compositions. It is, however, also a well known fact that in using greater quantities of earth alkali carbonate, for instance, over 5%, the enamels tend to become brittle and extraordinarily viscous. It is further known that the use of earth alkali oxides in quantities of more than 5% will make the enamel brittle.

According to my invention it is necessary to introduce the already formed double salt of alkali carbonate and earth alkali carbonate into the enamel compositions in order to obtain the desired flux effect. If the single compounds are added to the enamel batch, no double salt will be formed and all well known disadvantages will occur.

In carrying out my invention, a mixture of the following composition

	Per cent	calculated chemical composition Per cent
Feldspar	10.0	53.0
Quartz	35.0	2.3
Sodium calcium double carbonate	42.0	13.9
Sodium carbonate	5.0	8.4
Sodium saltpeter	1.5	20.4
Sodium fluosilicate	6.5	1.1

is melted at 900° C to 1000° C and granulated. The shot is ground to a dross with 2 to 10% colored or white pigment together with 5 to 10% clay and 40% water. After applying the dross to a suitable base it will be fired for 2 to 4 minutes at a temperature of 810 to 815° C.

The thus manufactured enamels have a good elasticity, a high thermal resistance, high gloss and a perfectly uniform smooth surface.

Boric acid or other boron compounds may also be substituted with advantage in the manufacture of glazes, under-glazes, glasses or the like. If alkali earth alkali double carbonates are used as fluxes, the same good properties in the products will be obtained.

WALTER KERSTAN.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREPARATION OF FATTY ACIDS FROM PRODUCTS OF THE CARBON OXIDE HYDROGENATION

Friedrich Martin, Mulheim-Ruhr, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 8, 1941

It has been proposed to prepare oxygen-containing carbon compounds by the addition of carbon oxide and hydrogen to alkene hydrocarbons. By means of a subsequent oxydation such compounds can easily be converted into carboxylic acids. This process is of special importance for the carbon oxide hydrogenation, since in this way valuable fatty acids and their conversion products can be prepared from easily obtainable mixtures of carbon oxide and hydrogen. However, a drawback of this preparation of fatty acids is the fact that these conversion products of the CO/H_2-synthesis usually contain only small quantities of alkenes.

It has been found that by a suitable combination of special synthesis conditions with subsequent cracking and appropriate oxydation very high yields of fatty acids can be obtained, including large quantities of the synthesis material.

In order to carry out this new combined method, the carbon oxide hydrogenation is performed under such conditions that the largest possible quantities of products boiling at temperatures over 200° C. (392° F.) are obtained. For this purpose one works, for example, with concentrated contacts and performs the synthesis at a fairly high pressure applying the circulation method. Considerable quantities of hydrocarbons of a decidedly alkene character and with a high boiling point are then obtained.

The synthesis products prepared in this way are subjected directly, or after a suitable fractionation, to a mild cracking process. It is advisable to perform this cracking at moderate temperatures, e. g. between 400° C. (752° F.) and 550° C. (1022° F.), by adding large quantities of water vapor. Hereby catalysers may or may not be used. The cracking products obtained contain large quantities of alkene hydrocarbons with a boiling point between 180° C. (356° F.) and 300° C. (572° F.).

These mixtures of hydrocarbons obtained by cracking are then treated with mixtures of carbon oxide and hydrogen, by using temperatures up to 200° C. (392° F.), high pressures (e. g. 50–150 atm.), and metal catalysers of the 8th group of the periodic system. The alcohols or aldehydes obtained by addition of watergas are oxidised to fatty acids by means of air, oxygen containing gases, or substances giving oil oxygen, by using suitable contacts which may, for instance, consist of the oxides of manganese, cobalt, or the like.

With the aid of the combined process in accordance with the invention, up to 50% of the synthesis products obtained by the hydrogenation of carbon oxide can without difficulty be converted into valuable fatty acids. These fatty acids are especially valuable because they have a highly ramified molecule structure. During the oxydation of paraffines, which up to the present has been used for the preparation of synthetic fatty acids, all molecule-ramifications disappear, and almost completely straight-chain products are obtained. On the contrary, by the addition of watergas to alkene hydrocarbons, the present molecule ramifications are completely preserved. Moreover, since the carbon oxide generally enters into the side-chain, further ramifications are obtained. As final product, high-molecular fatty acids are procured, which have a considerably higher solubility, foaming effect and washing capacity than the mainly straight-chain fatty acids at present obtainable by synthesis.

FRIEDRICH MARTIN.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREPARATION OF VALUABLE WAXES, RESINS, ARTIFICIAL SUBSTANCES, SOLVENTS AND SOFTENERS

Friedrich Martin, Mulheim-Ruhr, and Otto Roelen, Oberhausen-Holten, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 15, 1941

The group of waxes, resins, artificial substances, solvents and plasticifiers (softeners) chiefly includes the condensation- and polymerisation products, such as esters and ethers, which are obtainable in unlimited combinations from alcohols, aldehydes, ketones, carboxylic acids, especially high molecular fatty acids, or their derivatives respectively. As far as such substances or the basic substances necessary for their preparation are derived from natural sources, in particular from metabolic products of the animal or vegetable world, there is always the drawback that undesired protein compounds, glucosides, ferments or other additional compounds of unknown constitution and effect are also present.

The substances generally classified under waxes consist for example of esters of monobasic, high molecular fatty acids with principally high molecular monohydric alcohols, which do not belong to the glycerine series. Besides these esters and certain parts of free alcohol and free acids, they also contain glycerides which are easily decomposed under the influence of light and heat. The same is found in connection with the natural resins, softeners (plasticifiers) and solvents.

Since the impurities, even when there is only a trace of them, often produce undesired decompositions, their presence reduces the quality and durability of the final products obtained from natural raw materials. The undesired accompanying substances may, it is true, be removed by difficult and troublesome purifying processes, but these involve such great wastage that such methods are economically out of the question.

Besides undesired impurities, natural raw materials for the preparation of waxes, resins, artificial substances, solvents and plasticifiers have the disadvantage that on the one hand they are only available in limited quantities, and on the other hand it cannot be guaranteed that their composition and quality will always be uniform. Consequently, it has long been attempted to obtain the said substances by artificial means.

Two fundamental obstacles are met within the synthetic preparation of waxes, resins, and like substances.

In the first place the basic substances, which are directly required, such as high molecular alcohols, aldehydes or ketones, are difficult to obtain. In the present stage of technical development these substances are generally produced by working up or by decomposing suitable natural products, and thereby the disadvantages inherent in the natural products cannot be avoided.

In order to procure adequate and unlimited supplies of raw material it has already been attempted to prepare the high molecular oxygen compounds necessary for the synthesis (alcohols, aldehydes, ketones, carboxylic acids) by artificial means. But if, for example, in the preparation of waxes one starts with such intermediate products as are prepared synthetically with great difficulty, e. g. by the condensation of high molecular fatty acids with similarly prepared high molecular alcohols, the difficulty arises that such condensation products do not attain the good properties of natural products. The same difficulty is met with in the preparation of resins or resin-like substances, obtained from artificial resin alcohols, resin acids and resin esters. Also as regards the solvents and plasticifiers the synthetic products have not always been satisfactory. The same applies to the artificial substances.

These unfavorable properties of the said synthetic products are due to the fact that the artificial intermediate compounds used, e. g. high molecular alcohols, have no molecule-ramifications worth mentioning. But only from highly ramified basic synthesis substances can products be obtained which are strikingly similar to the natural substances. However, with the hitherto known methods, it is not possible to prepare sufficiently ramified intermediate products on scale for use in industry.

It has been found that oxygen containing carbon compounds, which are obtained when gas mixtures containing carbon oxide and hydrogen react in a catalytic way at a suitable temperature and under high pressure with carbon compounds having double or triple carbon bindings, are especially appropriate as a raw material for the synthetic preparation of waxes, resins, artificial substances, solvents and plasticifiers. When double bindings are present the watergas addition proceeds with an excellent yield between 50° C (122° F) and 200° C (392° F) and at 50–150 atm overpressure with metal catalysers, for example of the 8th group of the periodic system, in accordance with the following equations (R being an arbitrary organic compound-radical):

(1) $R.CH{=}CH.R + CO + H_2 = R.CH_2{-}CH.R{-}CHO$

(2) $2R.CH{=}CH.R + CO + H_2 = R.CH_2{-}CH.R{-}CO{-}CH.R{-}CH_2.R$

Aldehydes and ketones are chiefly procured hereby. By a subsequent catalytic reduction which, for example, can be carried out at high pressure while using Fe-, Ni- or Co- contacts ac-

tivated with ThO_2, MgO or Al_2O_3, the corresponding alcohols can be easily obtained thereby. By means of suitable working-conditions one can, when using an excess of hydrogen, also prepare alcohols directly in a single process. The aldehydes and ketones, prepared by the addition of watergas, can also be easily converted into carboxylic acids by the usual methods of oxidation.

In such additions of watergas and reductions or oxidations respectively all the ramifications present in the basic hydrocarbon are retained. Moreover further ramifications are obtained, since the carbon oxide generally enters into the molecule as a side-chain and not at the end.

It is of special advantage to use the products of carbon oxide hydrogenation as basic alkenic substances for the above reactions. They can be prepared in any required quantity from watergas mixtures which are easily available everywhere. The highly alkenic dieseloil obtainable therefrom contains, for example, more than 60% isocompounds with highly ramified chains, and is a very satisfactory basic substance for the synthesis of the above mentioned substances.

Through repeated condensation of unsaturated particularly alkenic carbon bindings, a completely graduated sequence of molecules can be built up according to size. For this purpose the oxygen compounds obtained through the addition of watergas are first completely hydrogenated, then dehydrogenated to alkenes containing one carbon-atom more per molecule, whereupon watergas is again added to these alkenes. In this way all oxygen compounds in question (alcohols, aldehydes, ketones, carboxylic acids) can be obtained with good yields and by contact reactions which are very easily carried out in industry, so that the intermediate products with highly ramified molecules, which are required for the condensation of resins and artificial substances, are easily available. In this way, for example, normal propylic alcohol and isobutylic alcohol which at present are hardly obtainable, are easily available in any required quantity. Similarly, the corresponding alcohols, aldehydes, ketones and carboxylic acids can be obtained up to the highest molecular weights.

When using basic substances obtained in the manner described above, the preparation (condensation) of waxes, resins, artificial substances, solvents and plasticifiers is much more easily effected than by using natural raw materials or raw materials which have been artificially prepared in a different way.

For the preparation of valuable waxes, which may be used for example as roller masses, a substance for binding paint, or for impregnations, finishing textiles, rubbing masses and as basic substance of ointments, equimolecular quantities of a carboxylic acid containing 16 carbon atoms per molecule, prepared as described in the above, are, for example, condensed with an alcohol containing 14 carbon atoms per molecule. By heating sufficiently and stirring vigorously the reaction takes place without a hitch. The final product obtained has better properties than, for example, bees' wax.

The preparation of oxygen containing derivatives of aliphatic hydrocarbons which are applicable as solvents can be conducted in such a way that by choosing appropriate conditions during the conversion, alcohols (and from these alcohols, if desired ethers) are either obtained directly, or the oxygen containing compounds first procured are converted to alcohols by reduction. In the first case one treats, for example, alkenes containing one C-atom less than the desired alcohols, or corresponding mixtures, with carbonoxide and hydrogen at higher temperatures than are necessary for the preparation of oxocompounds, e. g. over 150° C (302° F) at approximately 100 atm in the presence of catalysers which contain as operating substances Fe, Ni or Co and as activating additions thorium-, magnesium- or aluminium oxide, and which may be brought upon carriers, such as infusorial earth.

For the preparation of ester-containing solvents, the alcohol mixture obtained is oxidised under mild conditions in such a way, that only a part of the alcohol is converted into acids, whereupon the mixture is esterified in a known way, if desired, after a previous isolation of the free fatty acids. However, the preparation of the fatty acids necessary for the esterification may also be performed apart from the preparation of alcohol by direct mild oxidation of a mixture of conversion products obtained by catalytic treatment with watergas at high pressures and temperatures of between 50° C (122° F) and 200° C (392° F). In this way very valuable solvents and plasticifiers are obtained when carboxylic acids with more than 10 carbon atoms are condensed with alcohols with more than 8 carbon atoms to the corresponding esters.

FRIEDRICH MARTIN.
OTTO ROELEN.

Published July 13, 1943

Serial No. 376,225

ALIEN PROPERTY CUSTODIAN

EXTRACTING ALIPHATIC ACIDS

Max Weimann, Frankfurt, Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 27, 1941

The present invention relates to improvements in the extraction of aliphatic acids, particularly to the extraction of acetic acid from dilute aqueous solutions thereof.

The present application is a continuation-in-part of my application Serial No. 275,513, filed May 24, 1939.

It has already been known that aqueous solutions of aliphatic acids may be extracted countercurrently with organic liquids, such as ethyl acetate, in columns provided with filling material such as Raschig rings.

In my application Serial No. 173,949, now Patent No. 2,211,087, I have already described an improved process for increasing the extraction yield in such a process wherein the relative linear velocities of the dilute aqueous solution of the acid and of the extraction agent were generally maintained greater than .2 cm. per second with reference to the total cross-section of the extraction column. Therefore, in order to obtain the maximum extraction effect it was necessary to select an extraction column which was suitable for the desired throughput. If, however, only one extraction column was available and it was desired to lower the throughput, the amount of acids in the extracted aqueous wastes increased greatly and the efficiency of the apparatus considerably decreased. On the other hand, if the desired throughput was so great that the relative velocities of the liquids in the extraction column exceeded the upper limit the extraction effect was also lowered.

This is a great disadvantage as it is highly impractical for a plant to have different extraction columns available to take care of the variations in the amount of the dilute acids which are to be extracted at different times.

If the same extraction column were employed and the desired throughput below that described above, it is necessary to increase the amount of extraction agent employed to an uneconomical degree. In other words, to counteract the lessened extraction effect it is necessary to increase the proportion of the extraction agent employed considerably. In accordance with my invention it is possible, however, to obtain excellent yields of extraction for different throughputs even when employing the same apparatus.

I have discovered that the extraction effect which is obtained does not merely depend upon the diameter of the extraction column employed, but also upon the height at which the level between the two liquid phases, that is the level between the aqueous layer and the layer of extraction liquid, is maintained within the column and that if a maximum extraction effect is to be obtained in an extraction column the height of this level must be adjusted for the throughput desired. Therefore, when the throughput of the liquids through the extraction column is altered the level between the liquid phases in the column must also be altered until maximum extraction effects are obtained for the desired throughput. The level between the liquid phases is easily altered by temporarily altering the amount of extraction agent or aqueous acid introduced into the extraction column. For example, if the column of the extraction agent is to be increased, it is merely necessary either to increase the flow of the extraction agent into the extraction column temporarily or to decrease the flow of the aqueous acid into the column temporarily. On the other hand, if the level between the phases is to be altered in the other direction, it is merely necessary to increase the flow of the aqueous acid or decrease the flow of the extraction agent temporarily. After the most favorable height for the level between the liquid phases is ascertained, this is then maintained for the entire extraction. The level between the liquid phases will remain constant as long as the amount of liquids introduced and withdrawn from the extraction column are constantly maintained at the proper ratio for the extraction.

Previously the level between the phases within the extraction column has been maintained at a certain height without regard to the desired throughput of the liquids through the apparatus. For example, it has been usual to extract dilute acetic acid with ethyl acetate in such a manner that the aqueous layer was restricted only to the lower portion of the extraction column, namely, the portion which was not provided with filling material. In accordance with the present invention, however, it has been found that the lower the desired throughput the higher should be the level between the aqueous acid phase and the ester phase and such level may be within the portion of the column containing the filling material and even near the top of the extraction column.

It is not necessary to ascertain the proper level between the liquid phases in the extraction column each time the desired throughput is altered. It is possible, for example, to ascertain the proper level for a series of different throughputs through the apparatus employed and prepare a chart therefrom and then whenever a certain throughput is desired the level between the

liquid phases may be adjusted to the proper level with reference to such chart.

The extraction column employed in accordance with the present invention is preferably provided with means indicating the level between the two liquids with the column, so that the adjustment of the level between the liquid phases to the proper height is facilitated.

The following example serves to illustrate the present invention:

Example

An extraction column was employed which was 10 meters high and possessed a diameter of 1040 mm. The column was provided with cylindrical filling bodies having a maximum diameter of 35 mm. Into this column 4000 liters of 17% aqueous acetic acid and 1200 liters of ethyl acetate were fed countercurrently in such a manner that the ratio between the heights of the layer of aqueous acid and the layer of ester was 1:9. The aqueous layer was beneath the zone of the extraction column which contained the filling bodies. The aqueous wastes withdrawn from the column contained only 0.06%–0.08% of acetic acid, which means that the extraction yield amounted to 99.3%. By changing the throughput to 2000 liters of dilute acetic acid and 6000 liters of ethyl acetate in the same apparatus while maintaining the conditions of the extraction the same otherwise, the amount of acetic acid in the aqueous wastes withdrawn from the extraction column increased to over 1%. The extraction yield was therefore decreased to about 94%. By increasing the height of the line of division between the liquids to such a degree that the ratio between the height of the layer of aqueous acid and the height of the layer of ethyl acetate was 3:1 so that the line of division was within the zone of the extracting column containing filling bodies, the amount of acetic acid contained in the wastes withdrawn from the column was lowered to below 0.1% and the extraction yield was increased to 99.0%–99.5%. The most advantageous ratio between the two layers of liquids may, in every case, be easily ascertained for a given throughput in an extraction column by determining the amount of acid in the aqueous wastes. The desired ratio is substantially maintained after once adjusted if the throughput of the respective liquids is not substantially altered.

The above-described process is also applicable in the extraction of other aliphatic acids with known organic solvents.

MAX WEIMANN.

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Serial No. 376,926

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE CONVERSION OF ALDEHYDES CONTAINING A VINYL GROUP INTO THE CORRESPONDING ALCOHOLS

Hans Wagner, Frankfurt (Main), Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 31, 1941

The present invention relates to improvements in the production of unsaturated alcohols from unsaturated aldehydes which contain a vinyl group in the end position.

It is an object of the present invention to provide a process for the reduction of unsaturated aldehydes of the type of acrolein containing a vinyl group in the end position to the corresponding unsaturated alcohols wherein the production of saturated alcohols is minimized.

The present process is especially advantageous in the production of allyl alcohol from acrolein or allyl alcohol homologues from homologues of acrolein, such as, for example, the production of alpha-methyl-allyl alcohol from alpha-methyl acrolein.

In accordance with the present invention, the unsaturated aldehydes are reduced with the aid of aluminates of secondary alcohols which contain at least four, and preferably five to eight, carbon atoms. The conversion is easily achieved merely by mixing the reaction components and slight heating of the mixture. In many instances the heat of reaction which is produced by the admixture of the reaction components renders it unnecessary to employ supplemental heating. The proportions of the reaction components may be varied, but it has been found preferable to employ molar proportions or to provide an excess of the aldehyde.

It has been found that good results may be obtained if the unsaturated aldehyde is employed in excesses of up to 50%.

In production of the aluminum alcoholates, it has been found advisable to employ an excess of alcohol. The resulting alcoholic aluminate solution has been found very suitable for the reduction. The reduction, furthermore, may be carried out in the presence of inert diluents, but this precaution is generally not necessary.

The ketone which is obtained from the aluminate during the reduction of the aldehyde may be reduced to the secondary alcohol by known hydrogenation processes. The losses in the alcohol are very small, and it may be re-used again in the form of its aluminate for the conversion of the aldehyde in accordance with the present invention.

The conversion in accordance with the present invention is rapid. The reaction mixture which is obtained essentially contains only the desired unsaturated alcohol and the ketone which is formed from the aluminate. The unsaturated alcohol and the ketone are easily separated, if necessary, after acidification with sulfuric acid by simple fractionation.

In accordance with the present process, vinylated aldehydes, as, for example, butene-1-al-4, pentene-1-al-5, hexene-1-al-6, 3-methyl-pentene-1-al-5 and the like, may be converted into their corresponding unsaturated alcohols. The present process is especially applicable to the conversion of acrolein and its homologues, such as alpha-methyl acrolein or alpha-propyl acrolein. Examples of secondary alcohols, the aluminates of which may be employed as the reducing agent in accordance with the present invention, are as follows: Methyl-n-amyl carbinol, ethyl-n-propyl carbinol, methyl-isopropyl carbinol, ethyl-isopropyl carbinol and phenyl-n-ethyl carbinol.

Previous processes, when applied to the preparation of unsaturated alcohols from aldehydes containing a vinyl group, were not satisfactory in view of the fact that too strong a reduction is obtained whereby saturated alcohols are obtained in addition to the desired unsaturated alcohols. The production of these undesired saturated alcohols does not only lower the yield of the unsaturated alcohols, but also is very disturbing in that the saturated alcohols hinder the recovery of the unsaturated alcohols from the reaction mixture.

The process in accordance with the present invention suppresses undesired side reactions almost entirely, especially in the preparation of allyl alcohols from acrolein. This was not to be expected, especially in view of the fact that the starting materials in question are also easily converted into polymerization or condensation products. However, no polymerization or condensation of the starting materials can be ascertained in the process in accordance with the present invention.

For the success of the process in accordance with the present invention, it is necessary that the alcohol from which the aluminate is prepared is a secondary alcohol and contains at least four carbon atoms. For example, if acrolein is reduced with isopropyl aluminate, the strong reducing action obtained produces substantial quantities of the undesired n-propyl alcohol.

The following examples serve to illustrate the present invention:

Example I

During thirty minutes, 440 grams of 97% acrolein were allowed to run into the alcoholic aluminate solution obtained by dissolving 150 grams aluminum in 3000 grams methyl-n-amyl carbinol,

while stirring. The reaction is strongly exothermic in the beginning, and the reaction temperature was maintained between 65° C. to 75° C. by cooling. After the total quantity of acrolein was added to the aluminate solution, the reaction mixture was heated to 90° C. to complete the reduction. After cooling the resulting mixture to 40° C., the calculated quantity of aqueous sulfuric acid is added and the oily layer is decanted from the aqueous aluminum sulfate layer. The small quantities of the ketone and allyl alcohol contained in the aqueous layer were recovered by steam distillation and added to the decanted oily fraction. After drying, the oily fraction was subjected to fractional distillation. Substantially pure allyl alcohol was obtained having a boiling point 96° C. to 97° C. ($K_{p\ 760}$). The yield obtained was 366 grams from the 440 grams of 97% acrolein which were employed or, on other words, a yield of 82.8%. Even higher yields have been obtained when carefully controlled reaction conditions were employed.

Example II

While stirring and cooling, 46 grams of alpha-methyl acrolein were run into an alcoholic aluminate solution prepared from 18 grams aluminum and 219 grams methyl-n-butyl carbinol. After the end of the reaction, the reaction mixture was heated to 95° C. for a short period of time. After cooling the resulting reaction mixture, it was treated with an amount of aqueous sulfuric acid necessary for the decomposition of the aluminate. The oily layer was then separated from the aqueous aluminum sulfate solution. The oils obtained, including the portion recovered from the aqueous layer by steam distillation, were then dried with potassium carbonate and rectified. Substantially pure alpha-methyl-allyl alcohol having a boiling point 113° C. to 114° C. ($K_{p\ 760}$) was obtained. The yield amount to 37 grams or 81.5% of the theoretical.

HANS WAGNER.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREPARATION OF PURE OXYGEN CONTAINING DERIVATIVES OF ALIPHATIC HYDROCARBONS

Alfred Landgraf, Duisburg-Hamborn, and Otto Roelen, Oberhausen-Holten, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 4, 1941

It has been proposed to prepare aldehydes and ketones by a catalytic reaction between unsaturated hydrocarbons particularly alkenes, or alkene containing mixtures, and gas mixtures containing carbon oxide and hydrogen, e. g. watergas, at working pressures of over 50 atm, preferably 50–150 atm., and at temperatures below 200° C (392° F). preferably between 50° C (122° F) and 200° C (392° F). The folowing equations illustrate these processes:

$$(1)\quad R{-}CH{=}CH{-}R+CO+H_2=R{-}CH_2{-}\underset{\displaystyle R}{\underset{|}{C}}H{-}C\overset{O}{\underset{H}{}}$$

$$(2)\quad 2R{-}CH{=}CH{-}R+CO+H_2=R{-}CH_2{-}\underset{\displaystyle R}{\underset{|}{C}}H{-}CO{-}\underset{\displaystyle R}{\underset{|}{C}}H{-}CH_2{-}R$$

(R being a hydrogen atom or any given organic compound radical). The aldehydes and ketones obtained contain at least one carbon-atom more per molecule than the alkenes used for the reaction. Through oxidation these compounds can easily be converted into fatty acids, while the corresponding alcohols are obtained through a slight reduction, which can be effected, if desired simultaneously with the addition of watergas, when using an excess of hydrogen. If from these alcohols one separates one molecule of water, alkenes are obtained which contain one carbon-atom more per molecule than the alkenes used as basic substances.

When in this way technical alkene mixtures, such as the mixtures obtained by the cracking of hydrocarbons or by the carbon oxide hydrogenation are converted, the preparation of special pure aldehydes and ketones, or of the corresponding fatty acids and alcohols, presents great difficulties. The alkene mixtures always contain a large series of different alkenes which during the catalytic addition of watergas not only produce a mixture of the corresponding aldehydes and ketones, but also a large number of other oxygen containing compounds through subsidiary reactions. Thereby the obtaining of the pure single compounds is made very difficult, and in most cases is technically quite impossible.

These difficulties can be avoided when pure single alkenes are used as basic substances. In that case essentially well defined final products are obtained, which can easily be isolated from the unconverted basic substances.

However, this method is not applicable, since no pure alkenes can be obtained from the unsaturated hydrocarbon mixtures procured in industry. In such mixtures, alkenes of different molecule sizes are present in a mixture with a large number of saturated hydrocarbons. The separation of the alkenes from the paraffins is already extremely difficult. For this purpose it was suggested that selective solvents should be used (e. g. liquid sulphur dioxide), but in this way an economical and satisfactory separation of alkenes and paraffins was not obtainable. But even from an alkene mixture in which no paraffins are present, until now a technically simple preparation of pure, distinct alkenes, e. g. of a C_8- or a C_{10}-alkene, has not been possible. One can, it is true, by means of strong acids such as sulphuric acid, affect an almost complete separation of primary or secondary alkenes on the one hand, and tertiary alkenes on the other. However, this measure does not result in the obtaining of pure final products by means of the reactions in accordance with the above conversion equations.

It has now been found that notwithstanding the above mentioned difficulties, by the addition of watergas to unsaturated, particularly alkenic, hydrocarbon mixtures, one can obtain pure oxygen containing derivatives of aliphatic hydrocarbons, if the hydrocarbon mixtures to be used as starting materials are divided beforehand into suitably limited single fractions. According to the invention the fractionation of the hydrocarbon mixtures to be used, boiling e. g. between 150° C. (302° F.) and 350° C. (662° F.), is undertaken with reference to the expected final products. In this connection one makes use of the fact that an alkenic hydrocarbon always boils at a lower temperature than the oxygen compound, which is obtained from it by watergas addition.

These differences in boiling point between the alkenes and the oxo-derivatives containing at least one carbon-atom more per molecule are rather important. For example, in the neighbourhood of the C_6-alkenes and C_7-oxo-derivatives they amount to about 100°–120° C. (180°–216° F.) at atmospheric pressure. For the C_{12}-alkene and the C_{13}-oxo-derivative a difference of about 50° C. (90° F.) is observed, at a distillation pressure of 20 mm. mecury, and between C_{17}-alkenes and C_{18}-oxo-derivatives there is still a difference of about 25° C. (45° F.) in boiling points at 5 mm. mercury.

While making use of the relationship of these boiling points, in accordance with the invention the alkenic hydrocarbon mixture used can be divided into single fractions, in such a way that the highest boiling alkene has a lower boiling point than the oxo-derivative obtained from the lowest boiling alkene. In this way the reaction mixture obtained by the addition of watergas can during

distillation be easily divided into three fractions separated from each other by sufficiently great differences in boiling points. The lowest boiling fraction contains the unconverted hydrocarbons (C_n); the next fraction contains the aldehydes procured in accordance with the first of the above mentioned conversion equations, or the alcohols obtained therefrom by the addition of watergas C_{n+1}); while the distillation residue contains the ketones (C_{2n+1}) obtained in accordance with the second equation, and higher reaction products (such as acetales and the like).

Hereunder the way in which the new process is carried out is described in greater detail for the working up of a heavy oil fraction of synthetic or natural origin, boiling between 165° C. (329° F.) and 330° C. (626° F.).

Before the watergas addition the original mixture of alkenic hydrocarbons is divided in four fractions with the following ranges of boiling point:

1st fraction 165°–220° C. (329°–428° F.), C_{10}–C_{12}-alkenes
2nd fraction 220–255° C. (428–491° F.), C_{13}–C_{14}-alkenes
3rd fraction 255–295° C. (491–563° F.), C_{15}–C_{16}-alkenes
4th fraction 295–330° C. (563–626° F.), C_{17}–C_{19}-alkenes

From these groups of hydrocarbon mixtures, through the catalytic addition of watergas, oxo-compounds are obtained of the following molecule sizes respectively:

From the 1st fraction C_{11}-C_{13}-oxo-derivatives are obtained
From the 2nd fraction C_{14}-C_{15}-oxo-derivatives are obtained
From the 3rd fraction C_{16}-C_{17}-oxo-derivatives are obtained
From the 4th fraction C_{18}-C_{20}-oxo-derivatives are obtained

The range of temperatures at which each fraction of these oxocompounds boils is much higher than the highest boiling point of the corresponding alkene-fraction used as basic substance. During the working up of the reaction products obtained which, after removal of the catalyser used and preferably after the subsequent reduction of the aldehydes to alcohols, is carried out through fractionated vacuum distillation, the hydrocarbons present and the oxocompounds obtained cannot overlap each other, so that the aldehydes or alcohols are obtained in a pure state.

The aldehydes or alcohols obtained are easily oxidised to fatty acids in the usual way. Since the alkenes originally used can be almost perfectly separated, when necessary into single molecular sizes, in this way quite distinct alcohols, aldehydes, and fatty acids can be obtained. For industrial purposes, (for example for the preparation of washing materials), fractionation up to 3 molecule sizes is generally sufficient. The hydrocarbons left over in the treatment of the products obtained by the addition of watergas can be re-used as basic substances in the process.

As regards their purity, the fatty acids obtained as described above comply with all the requirements for basic substances for the soap- and washing means industry. They can also be used for many purposes in the preparation of articles of food. The corresponding alcohols are particularly suitable as solvents, or in the preparation of synthetic resins.

As basic substances for the present process all unsaturated hydrocarbon mixtures of natural or synthetic origin can be used, for example, fractions of the thermic or catalytic hydrocarbon-cracking, or of the pressure-hydrogenation. Because of their high degree of purity, synthesis products of carbon oxide hydrogenation are particularly suitable.

Next to the preparation of valuable fatty acids and alcohols the process as described above can also be used for the preparation of pure alkenes. In this case the corresponding single alcohols are first prepared, whereupon they are converted to alkenes, for example by means of phosphoric acid under removal of water. It is well known from experience that alcohols can be very satisfactorily separated from each other, so that in this way even isomeric alkenes, with almost identical boiling points can be most satisfactorily isolated. Since the addition of watergas chiefly results in producing side chains, in this way ramified alkenes, which are very valuable for many applications, become easily available.

In the separation of C_4-fractions, from the possible C_4-alkenes, namely isobutylene (isobutene, boiling point = −6° C. or 21° F.), asymmetrical butylene (butene- 1, boiling point = −5° C. or 23° F.), and symmetrical butylene (butene-2, boiling point = +1° C. or 34° F.), the two first mentioned cannot be separated from each other by distillation. If one converts the C_4-alkene mixture through the addition of watergas and subsequent reduction into the corresponding C_5-alcohols, one obtains from isobutylene an isoamylic alcohol (boiling point 130° C. or 266° F.), or a secondary amylic alcohol (methylisopropylcarbinol) boiling at 113° C. (235° F.), while from the asymmetrical butylene (butene-1) the normal, primary amylic alcohol, boiling at 138° C. (280° F.) is obtained. These C_5-alcohols can easily be separated from each other. Through removal of water from these alcohols the corresponding pure C_5-alkenes are obtained.

ALFRED LANDGRAF.
OTTO ROELEN.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF POROUS BODIES

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No Drawing. Application filed February 28, 1941

My invention relates to the production of bodies having a vesicular structure, and more particularly to solid porous bodies for building purposes.

Hitherto it was known to produce the cellular structure of solid porous bodies by gas generation in a paste containing hydraulically binding substances such as cement, gypsum or the like, and, if desired, also filling materials, e. g. sand, textiles or the like. The gas generation has been accomplished by the addition of gaseous, oxygen evolving compounds like hydrogen peroxide. In order to reduce the cost of the production, hypochlorites were sometimes added which, in the presence of peroxygen compounds, liberated their active oxygen. Instead of hypochlorites also decomposition catalysts, for example compounds of the heavy metals, e. g. manganese sulfate, have been used. And finally it was also known to stabilize the pores formed by the gas generation of the mixtures, in adding substances which reduced the surface tension such as soap, glue or the like, in order to inhibit an useless escaping of the oxygen evolved and to prevent a partial reduction of the risen paste.

To obtain satisfactory results in the manufacture of the gas generating mixture it was heretofore necessary to observe a pre-determined order as to the addition of the components to the mixture. A paste was made from cement, water, stabilising substances, hydrogen peroxide or other peroxygen compounds, and if desired, filling materials such as sand and finally, the accelerator for the decomposition of the peroxygen compounds, for instance, hypochlorite, introduced. This procedure succeeded in a slow, at the beginning very fine-vesicular gas generation which lasted several hours. The paste, homogenized during the rising process, was then cast into the molds and, to avoid any percussion, allowed to stand until the gas generation had finished.

Now I have found that the rising of the paste may substantially be accelerated without the escape of considerable quantities of the developed oxygen from the paste if the pore stabilising substance is introduced simultaneously with the last added component.

Since cement exerts a stabilising effect on the peroxygen compounds and consequently delays the gas generation process it has proved advantageous for the preparation of light concrete according to my invention, to first mix cement, water, hypochlorite and filling materials whereafter the pore stabilising substance is added simultaneously with the hydrogen peroxide. Immediately after the preparation of the mixture the gas generation is starting and ends in a considerably shorter time than usual. The pores which are formed according to this working method are extraordinarily stable and make it possible to finish the gas generation of the mass in the mixing vessels before the mixture is cast into the molds, contrary to the hitherto known methods where it was necessary to cast the paste into the molds as quickly as possible whereby the gas generation was accomplished in the molds. Since it is not necessary to form the mass in the mixing vessels the charges may be considerably enhanced. Moreover, the molds into which the already gas generated mass is cast, may be filled up to the brim since the volume of the mass will not be increased by any subsequent gas generation. In this manner any losses of material will be prevented which hitherto were quite unavoidable because the measure of the last rising could not exactly be foreseen and the molds had mostly be filled so abundantly that they contained an excess of material which afterwards was stricken off and cast away.

According to another embodiment of my invention only one part of the generating agent, for instance, hydrogen peroxide, and the pore stabilising agent are finally added to the cement mixture whilst the remaining part of the hydrogen peroxide and, if necessary, also a part of the stabilising agent are added to the mixture of cement, water and filling materials before the accelerator for the decomposition of the hydrogen peroxide, for example, hypochlorite, is introduced. In practicing this method the first part of the hydrogen peroxide which was added before the hypochlorite is introduced, is stabilised by the cement present whilst the second and later added part of the hydrogen peroxide is decomposed and liberates oxygen immediately after the admixture to the paste. Hereby very fine bubbles are formed which serve as nuclei for the now beginning gas generation from the first slowly decomposing part of hydrogen peroxide.

According to my invention it is possible to obtain bodies with either fine or coarse vesicular structure by careful measurement of the quantitative portions of the hydrogen peroxide added in two operation steps. The greater the portion of the first added quantity of hydrogen peroxide, the coarser the pores in the structure of the final product.

Another means for influencing the size of the pores has been found in the selection and unit of quantity of the stabilising substance. For this

purpose substances with a reducing effect on the surface tension may be used, for instance, soap, glue, Turkey red oil, tar oils, e. g. wood or coal tar oil of a fraction between 100–300° C. as well as products which are obtained by an alkaline extraction of wood pitch and subsequently concentrated. Really excellent results were obtained in employing saponine and/or, surprisingly enough, with the use of skim milk. If skim milk is used, a very distinct dependence of the size of pores on the quantity of milk added was observed. Reducing the quantity of milk increases the size of the pores. The same laws could be observed in adding saponine and other stabilizers, but not to the same degree as in adding milk. If, for instance, 5 cc of skim milk are added to a mixture of about 1 kilogram cement and sand which represents an amount of 0.5% milk, a very fine porous structure was obtained whilst an addition of 0.3 to 0.2% of milk increases the size of the pores in a considerable manner. According to my invention it is therefore possible if skim milk is added to the cement mixture, whereby the H_2O_2 is introduced in a two step process to obtain well reproducible bodies with a primarily determined size of pores. This is, of course very important in large scale production. A further advantage of the addition of milk and/or saponine is that both components may be well mixed with a solution of hydrogen peroxide. It is therefore expedient to add a solution of saponine in hydrogen peroxide or of a homogeneous mixture of milk and hydrogen peroxide to the pulp and then distribute the added substances in the pulp which warrants that in the place where hydrogen peroxide is decomposed and oxygen evolved, the suitable quantity of the pore stabilizer will be present.

All operation steps described above for cement mixtures are also applicable to other substances, hardening with water, as for instance, gypsum. But since gypsum exerts no stabilising effect on peroxygen compounds, the whole quantity of the gas generating substance, for example, hydrogen peroxide, may be added without any deleterious effect before the decomposition accelerating substances, e. g. manganese sulfate, hypochlorite and the like, are introduced. It is only essential that the pore stabilizer is added at the end of the operation either simultaneously or admixed to one of the substances which participate at the oxygen generation, that is either with the gas generator such as hydrogen peroxide or with a decomposing substance, for instance, hypochlorite or with a decomposing catalyst such as compounds of manganese, iron, nickel, cobalt, or catalyses or the like.

Example 1

375 cc of a calcium hypochlorite suspension (100 grams hypochlorite with nearly 31% active chlorine, suspended in 150 cc water) are intimately mixed with 2200 cc of water, 800 grams of sand (less than 1 mm mesh) and 3200 grams of cement. To this mixture 90 cc of a solution containing 50 cc of a 40% hydrogen peroxide, 4 cc skim milk and 1.5 grams saponine are added. After a thorough mixing the gas generation starts immediately whereupon the original paste rises to a multiple of its former volume. If the pulp is immediately poured out, a slight increase of the volume will be observed in the mold, whilst no modification of the volume is occuring if the foam is allowed to stand for a quarter of an hour. Porous bodies will then be obtained which correspond accurately to the prescribed form. In this manner bodies with an absolutely uniform porous structure are obtained.

Example 2

To a pulp of concrete, containing 2200 cc of water, 3200 grams of cement and 800 grams of fine sand, 5 cc of a 40% hydrogen peroxide solution with 4,5% saponine are added and the whole mixture vigorously stirred. Then a suspension of 375 cc of a calcium hypochlorite solution (according to Example 1) and finally 45 cc of a 40% hydrogen peroxide solution with 4,5% saponine are added and the paste thoroughly mixed.

Example 3

To a pulp of concrete which contains 210 cc water, 730 grams sand with a size of 0,3 mm mesh and 312 grams of cement, 2 cc of a 40% hydrogen peroxide and 25 cc of a calcium hypochlorite suspension (including 400 grams of a 30 to 31% active chlorine containing calcium hypochlorite and 600 cc of water) are intimately homogenized. Thereafter 1,5 cc of 40% hydrogen peroxide together with 5% skim milk are incorporated simultaneously and the whole pulp thoroughly mixed. During the mixing operation after the addition of the last component the gas generation starts with a considerable increase of volume. The charge is immediately cast into the molds.

Example 4

0,8 liters water are intimately mixed 50 cc of a sodium hypochlorite solution (11% active chlorine) and 870 grams commercial gypsum added until a homogeneous paste is formed. In this paste 6 cc hydrogen peroxide (40%) with 0,3 gram saponine are incorporated. It results the instantaneous development of foam with the formation of very small stable pores. After casting into the molds, articles with a seeming specific gravity of 0,28 are obtained.

Example 5

6 cc of a 40% hydrogen peroxide solution are added to a pulp of 800 cc water and 870 grams gypsum. To this mixture a suspension of 5 grams pyrolusite in 5 cc of an aqueous solution of 4% saponine is added, the whole mass well homogenized until the gas evolution is practically ended. It results a very stable froth. The molds may be filled out completely and no further increase of volume will be observed.

Example 6

Into a pulp of 800 cc water and 870 grams of gypsum, 6 cc hydrogen peroxide (40%) are added whilst stirring. Then 1,8 cc of a solution containing 2 grams of crystallized manganese sulfate in 60 cc of water and 10 cc skim milk are incorporated, whereupon 1,7 cc of a concentrated ammonia solution are added and the whole mass thoroughly stirred. The well homogenized paste is cast into molds whereupon the gas generation starts with an increase of volume. It results an article with an extraordinarily fine-vesicular structure.

Example 7

The same composition as in Example 6 is prepared but with the addition of 5 cc skim milk only. A solid porous body with a coarse-vesicular structure is obtained.

JOSEF SCHNEIDER.

Published July 13, 1943

Serial No. 387,106

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PREPARATION OF SIX MEMBERED N-HETEROCYCLIC COMPOUNDS FROM ACROLEIN OR ITS HOMOLOGUES AND AMMONIA

Fritz Stitz, Frankfurt (Main), Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 5, 1941

The present invention relates to an improved process for the production of six membered N-heterocyclic compounds from acrolein or its homologues and ammonia.

The object of the present invention is to provide an economical and efficient process for the production of six membered heterocyclic compounds from acrolein or its homologues and ammonia.

Several syntheses for the production of six membered heterocyclic compounds from acrolein and ammonia, which, for the greater part, are carried out in the liquid phase, are known. However, all of these syntheses have led only to the most complex mixture of a great variety of substances, and six membered heterocyclic compounds were obtained in such minute quantities in these mixtures that the use of these processes upon a commercial scale for the production of these heterocyclic compounds was not feasible.

It has now been discovered that the valuable six membered heterocyclic compounds could be obtained in good yields by passing acrolein and ammonia in the vapor phase in admixture with an inert diluent over dehydration catalysts. The diluents which may be employed are, for example, hydrocarbons or their derivatives, such as benzene, homologues, gasolene, methanol, and steam. Steam has been found to give especially good results as it tends to activate the catalyst and to speed the reaction.

Besides acrolein, such acrolein derivatives as alpha-methyl acrolein, alpha-ethyl acrolein, phenyl acrolein and cinnamic aldehyde and the like may be employed.

The proportions of acrolein and ammonia employed may be varied within wide ranges. It is advisable, however, to employ an excess, preferably a large excess, of ammonia.

The proportion of diluent with respect to both other reaction components may also be varied within wide limits. However, as the addition of the inert diluent in accordance with the present invention produces a substantial increase in the yield of the heterocyclic bases and, at the same time, reduces resin formation and increases the lift of the catalyst, it is advisable not to have the proportion of the inert diluent too small. Good effects are, for example, obtained when employing a quantity of steam which is about one-half the weight of the other components of the reaction mixture. However, good results are also obtained when employing smaller quantities and substantially greater amounts of steam. The preferable proportions are between 2–20 times of diluent with respect to the acrolein.

If no diluents are employed, such as, for example, when leading a mixture of only acrolein and ammonia over aluminum oxide, large quantities of resin are obtained which causes the reaction to cease in a very short time.

The dehydration catalyst employed in accordance with the present invention may, for example, be aluminum oxide, active silica, aluminum phosphate, zinc phosphate, and the like. The dehydration catalysts may be employed in any desired combination with each other and may also be placed on carriers such as asbestos, active charcoal, and the like.

The reaction temperatures employed in accordance with the present invention generally lie between 200° C. and 600° C. Preferably temperatures between about 250° C. and 400° C. are employed.

In some cases it is advantageous to pass the substances over the catalyst with not too long a period of contact with the catalyst. For example, good results are obtained when ½ mol of the substrate and more, preferably 1 mol, is passed over per liter of contact mass per hour. Such liter of contact mass is measured as the amount of contact mass which will be required to fill a liter container when poured in and not compacted. The period of contact of the reaction components with the catalyst during their passage through the catalyst mass preferably is between 1 and 10 seconds.

A modification of the invention resides in adding saturated aldehydes, such as formaldehyde and acetaldehyde, to the reaction mixture. In this manner it is possible to influence the type of product obtained. For example, in accordance with the invention a mixture of acrolein, ammonia and steam will produce picoline, whereas if acetaldehyde is added to this reaction mixture increased quantities of pyridine are obtained.

The following examples serve to illustrate the present invention, but it is in no way limited thereto:

Example 1

A mixture of 200 cubic centimeters of 93% acrolein were passed, together with an excess of ammonia, through a V2A contact tube filled with 800 cubic centimeters of aluminum phosphate at a temperature of 300° C. for seven hours. During this experiment 200 grams of steam were introduced into the reaction mixture. The quantity of ammonia consumed was 280 grams. The condensate was salted out with sodium hydroxide

and the oil which separated was dried over barium oxide. The yield was 89.8 grams of picoline having a boiling point of 130° C. to 145° C. or 69% of the theoretical.

Example 2

A mixture of 18% aqueous acrolein and 280 grams ammonia was passed over aluminum oxide in a contact tube. The temperature employed was 375° C. The yield was 73.5 grams of picoline having a boiling point of 130° C. to 145° C. or 74% of the theoretical.

Example 3

A mixture of 112 grams of acrolein (95%), 88 grams of acetaldehyde, 250 grams ammonia and 200 grams of steam was passed over aluminum oxide in a V2A contact tube for six hours at a temperature of 380° C. A yield of 38.5 grams of pyridine having a boiling point of 100° C. to 125° C. was obtained.

FRITZ STITZ.

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Serial No. 385,578

ALIEN PROPERTY CUSTODIAN

DEVICE FOR STIRRING MELTS

Hans Bernstorff, Frankfurt A. M., and Albert Allendörfer, Bad Homburg, Germany; vested in the Alien Property Custodian

Application filed March 27, 1941

Our invention relates to a new device for stirring melts, especially metallic melts, and serves at the same time to control the temperature of the melt. A further object of our invention is the use of the new device in the vacuum casting of metals.

In melting or casting metals, mixtures of metals or other substances, it is often necessary to stir the molten mass, for instance, in order to push through the oxide film formed on the surface before the melt is cast, or in order to attain a quicker homogenisation. In all these cases it is necessary to control the temperature of the melt. If the melt consists of substances which in molten condition are very susceptible against gases on account of their strong reactivity at elevated temperatures, it has proved advantageous to work in vacuo. In this case, however, the stirring of the melt and measuring of the temperatures encounters some difficulties as the stirring and measuring device to be removed before the melt is cast or solidifies.

Now we have constructed a new device which combines both aims and may be introduced into and removed from the melt without any difficulty.

The device consists of two rotatable, at the bottom conically shaped bodies (*a* and *b*), arranged in a suitable case *c* which, for instance, is fixed on the lid of the vacuum furnace. The inner device releases the stirring, the outer device the introduction and removal of the measuring contrivance.

The stirring is released by turning the upper part of the conically shaped device *a* in the fat sealed device *b*. Thereby the rod *d* which contains the stirring and measuring equipment *e* makes a circular arc, being connected over an excenter *f* with the contrivance *a* which protrudes into the lid. In the part of the rod *d* which is opposite of the excenter, a slot *g* is provided which accompanies the turning movement of the holding rod *h*.

In this stirring device which, for instance, may be consist of a tube, of refractory material ("Pythagoras mass") the temperature measuring device is arranged in form of a thermocouple *i*. Before the melt *k* is poured out or solidifies, the stirring and measuring device is removed from the melt by the contrivance *b* whereby the stirring device *a* is locked in its upper part and the contrivance *b* is turned in the case *c* around the device *a* in such manner that the coil *l* is winding up the suspension device *m* of the measuring apparatus, whereby the latter is drawn up and removed from the melt. If the measuring and stirring apparatus is again introduced into the melt, the device *b* is moved in opposite direction whereby the suspension appliance *m* unrolls from the coil and the measuring apparatus is gliding into the melt through the weights (n_1 and n_2). It has proved advantageous to conduct the stirring and measuring device through a tube o which is arranged at the rod *d*.

HANS BERNSTORFF.
ALBERT ALLENDÖRFER.

PUBLISHED
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BY A. P. C.

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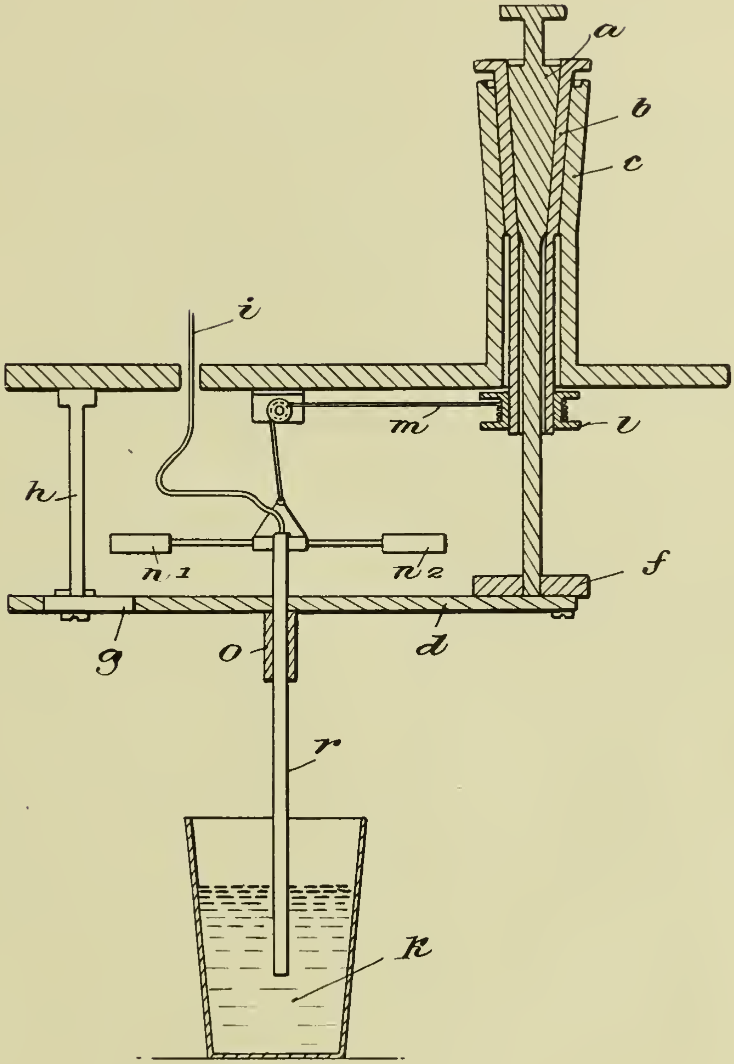

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ALIEN PROPERTY CUSTODIAN

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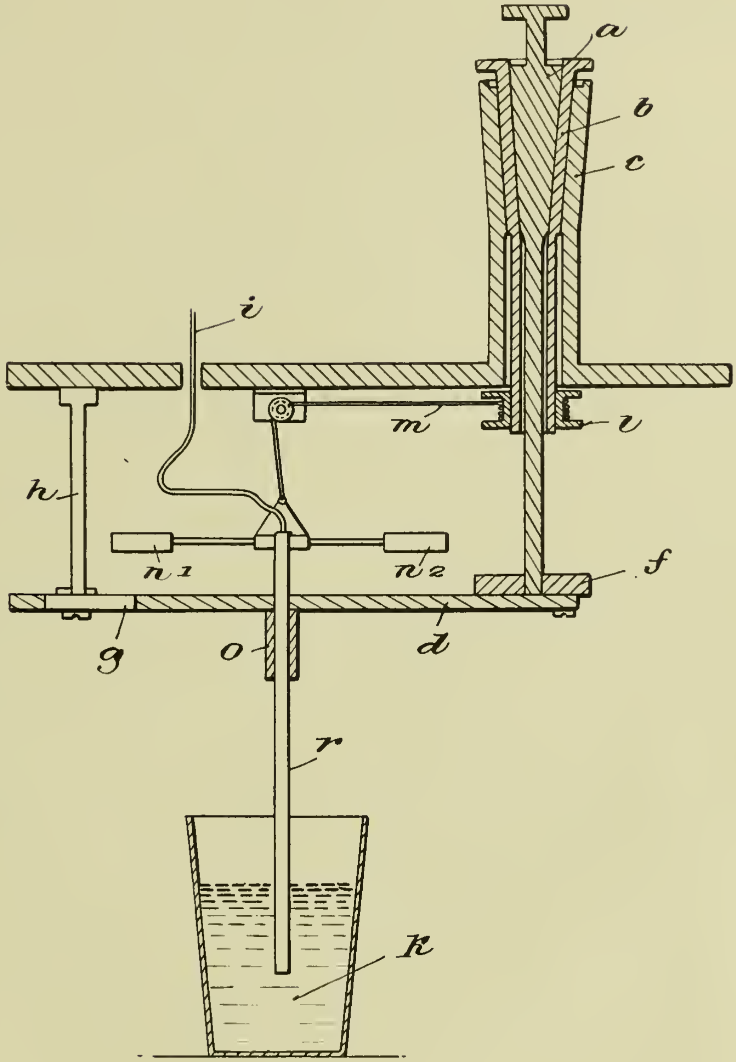

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ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR THE COMMINUTION OF FUSED MATERIALS

Otto Landgraf, Frankfurt (Main), Germany; vested in the Alien Property Custodian

Application filed April 16, 1941

The present invention relates to an improved process and apparatus for the conversion of fusible materials into finely divided form.

The present application is a continuation-in-part of my application Serial No. 367,286, filed November 26, 1940.

It is known that fusible materials may be comminuted by causing a stream of such materials in molten condition to impinge upon a rapidly rotating element which may be cooled with a cooling fluid, such as water. In many instances, a bath of cooling liquid is also provided below such rotating element to catch the comminuted particles which are thrown from the rotating element. It has been found, however, that a portion of the comminuted particles leaving the rotating element is not thrown into the bath of cooling liquid, but is thrown upwardly. These particles, in some instances, may adhere to the walls of the casing which surrounds the rotary element and even to the cover thereof. As soon as one particle has adhered to the casing it was found that other particles which are thrown in the same direction have a greater tendency to adhere to such particle than to free portions of the casing and, consequently, large, lumpy agglomerations are soon formed. These agglomerations not only decrease the yield of the desired finely comminuted material, but also have the disadvantage that they have deleterious effects upon the comminution apparatus. Sometimes when such lumpy agglomerations have reached a certain size their weight causes them to drop and, because of the considerable weight of such falling agglomerations, they can cause great damage to the rapidly rotating element. Also, sometimes the particles are thrown up substantially vertically from the rotating element and thereby may start the formation of agglomerations at or near the nozzle serving to supply the stream of fused material to the rotating element so that clogging of such nozzle rapidly takes place.

In accordance with the present invention, it has now been found that the formation of these agglomerations upon the inner surfaces of the casing surrounding the rotating element may be substantially avoided by surrounding the stream of fused material which is directed toward the rotating element with a jacket or shield of material upon which the comminuted particles do not easily adhere. Such jacket surrounds the nozzle through which the stream of fused material is directed against the rotary element and extends to the rotary element. Preferably such jacket is composed of several parts. For example, the upper portion of such jacket may be of solid material, while the lower portion is composed of a fluid, such as a cooling liquid. Preferably the solid and fluid portions of the jacket overlap. It is, however, possible to employ a fluid for the entire length of the jacket or shield for the stream of fused material to be comminuted.

The fluid portion of the jacket serves to deflect the comminuted particles which are thrown up towards the nozzle which serves to supply the stream of fused material to the rotating element and to carry such particles back to such element. Furthermore, the fluid portion of the jacket serves to cool and lubricate the particles of fused material as soon as they are formed upon the rotary element. Care must be taken, however, that the stream of cooling fluid forming such jacket only strikes the stream of fused material at the point at which such fused material strikes the rotating element.

Preferably the cooling fluid which serves to form the fluid portion of the jacket surrounding the stream of fused material is supplied through an annular nozzle surrounding the stream of fused material, which nozzle is of such conicity that a conical, hollow stream of cooling fluid is produced which only comes into contact with the fused material substantially as it strikes the rotary element. The conicity of the annular nozzle also causes another advantage, namely, in that the hollow stream of cooling fluid is compressed whereby spreading thereof is substantially reduced. In this manner it is possible to contact the cooling fluid with the fused material substantially at the time at which it strikes the rotating element and is comminuted thereby. This leads to large yields of finely comminuted material.

The upper portion of the jacket surrounding the stream of fused material may be constructed of a solid material. It has been found advisable to provide the surfaces of such solid portion of the jacket as well as the surfaces of the casing surrounding the comminution apparatus with a coating of a lubricating material to minimize the adherence of metal particles thereto. It has been discovered that a thin coating of graphite is sufficient practically to prevent the adherence of the fluid or more or less solidified particles which are thrown thereagainst during the comminution. Instead of graphite, other lubricating materials may be employed which, however, must maintain their properties at the temperatures to which they are subjected. Preferably the upper portion of the jacket surrounding the stream of

fused material is a carbon tube, the surfaces of which are provided with a coating of graphite. The tube may also be of ceramic or other material upon which a layer of graphite may be applied. The coating of graphite need only be an extremely thin film. A thicker coating is disadvantageous as it may become brittle.

The stream of fused material and its surrounding jacket of cooling fluid are preferably directed so that they strike the rotating element near its periphery. The rotary element employed is preferably provided with beating members such as, for example, a rotary disc provided with slots and ribs adjacent such slots or rotary discs provided with vanes. The annular cooling fluid stream and the stream of fused material should be such that they intersect only upon the disc.

Many types of materials may be comminuted in accordance with the present invention. For example, noble and base metals, such as gold, silver, platinum, copper, iron, nickel, lead, aluminum, magnesium and sodium as well as their alloys, may be comminuted. Also products such as litharge, sodium hydroxide, zinc chloride, tin chloride, ammonium nitrate, naphthalene, slags and the like may be treated in accordance with the present invention.

The cooling fluid employed preferably is water. However, if water is too reactive or possesses dissolving effects upon the material other more inert liquids may be employed. The method of supplying the cooling fluid in accordance with the present invention renders it possible to employ water in the comminution of aluminum to produce an extremely finely subdivided aluminum powder capable of sintering.

Gaseous mediums may also be employed in accordance with the present invention as the fluid portion of the jacket surrounding the stream of fused material. However, the use of a gaseous medium is less preferred as its cooling action is generally less than that of a cooling liquid.

The accompanying drawings serve to illustrate, by way of example, an apparatus suitable for carrying out the present invention, in which:

Fig. 1 shows a vertical section of an apparatus in accordance with the present invention; and

Fig. 2 is an enlarged view of a portion of the apparatus shown in Fig. 1 showing the relationship between the stream of fused material being comminuted and the surrounding fluid jacket as they impinge upon the rotary element.

In the drawings, 1 represents a crucible for supplying the fused material to the comminution apparatus. An outlet 2 is provided in the bottom thereof from which a thin stream of fused material 11 flows to strike the rapidly rotating element 3 at 4. The stream of fused material 11 is surrounded by a spaced annular jacket or shield which is composed of the solid tube 5 and the conical fluid jacket 6. Preferably such tube 5 is of carbon and the surfaces thereof are coated with graphite. The lower end 7 of the tube is preferably tapered to a sharp edge in order to present as little surface as possible to which the comminuted particles which are thrown up may adhere. Furthermore, the tapered end has a knife-like action whereby the particles which are thrown are comminuted still further.

The fluid or liquid is supplied to the receptacle 9 through conduit 8 and flows from such receptacle to the annular nozzle 10. This nozzle is of such conicity that the fluid jacket emitted therefrom only strikes the stream of fused material as they simultaneously strike the rotating element. Preferably the conicity of such nozzle is such that the fluid jacket strikes the rotating element at a slight distance from the point where the stream of fused materials strikes such element as shown in Fig. 2. This assures that the fluid only contacts the fused material in the moment that the particles are produced. The fluid is preferably forced out of the annular nozzle under pressure as this tends to prevent spreading of the resulting fluid jacket and thereby prevents premature contact thereof with the fused material.

The conduit 8 is also preferably arranged tangentially with respect to the receptacle 9 so that the fluid in the fluid jacket emitted from the nozzle 10 swirls.

The inner walls of the casing 12 which surround the comminution apparatus may be also coated with graphite so that adherence of comminuted particles will be hindered. The construction of tube 5 and the fluid jacket 6 substantially prevents adherence of comminuted particles to the outlet 2 for supplying the fused material for comminution as well as the mouth of tube 5. The total height of the jacket, namely, from outlet 2 to the rotating element may, for example, be up to one-half meter and thereover.

OTTO LANDGRAF.

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O. LANDGRAF

PROCESS AND APPARATUS FOR THE COMMINUTION OF FUSED MATERIALS

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Fig. 1

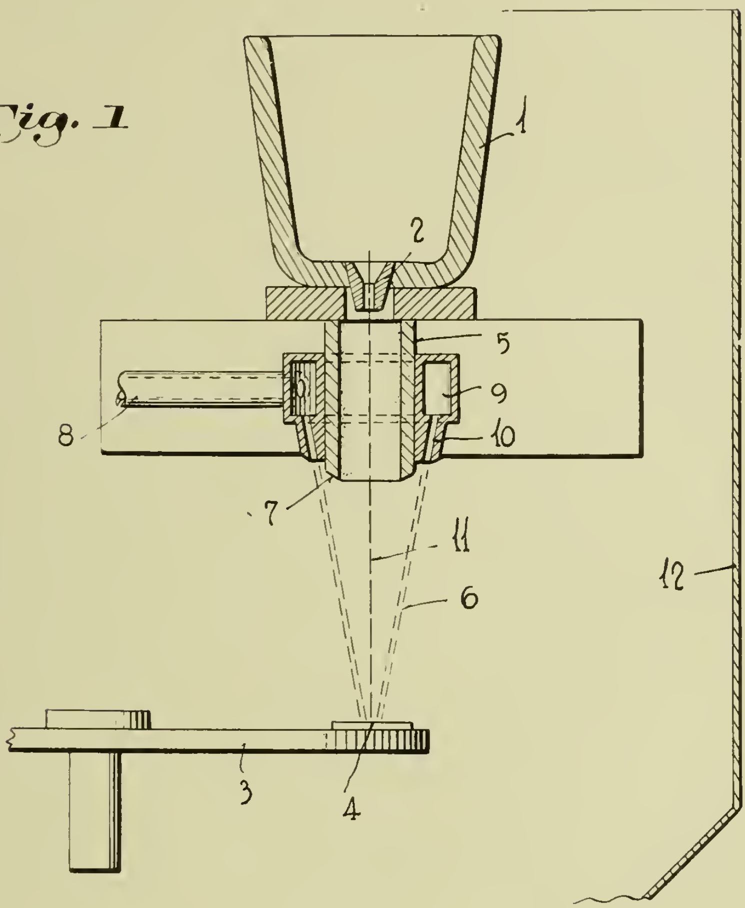
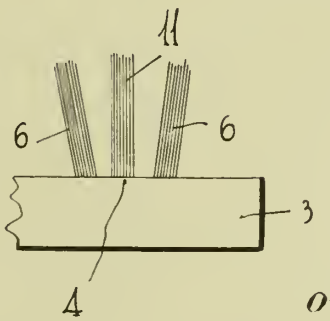


Fig. 2



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR CHEMICAL REACTIONS IN MELTS

Walter Beck and Hans Walter, Frankfurt/Main, and Klaus Bonath, Kronberg i/Taunus, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 13, 1941

The present invention relates to improvements in carrying out reactions between gaseous or vaporous reactants.

This application is a continuation-in-part of our application S. N. 292,742, filed August 30, 1939.

It is an object of the invention to provide a process for carrying out reactions between gaseous or vaporous reactants wherein it is possible to control the temperature of the reaction very exactly.

In accordance with the present invention, the gaseous reactants are introduced into a molten bath, preferably a salt bath, and are maintained in such bath until the desired reaction is completed. The molten bath primarily serves as a heat exchanging medium, but also advantageously serves as a catalyst or a catalyst carrier. The reactants are preferably introduced into the molten bath in a finely divided form through nozzles in order that they thoroughly and uniformly intermix with the molten bath, and, also, in order that such gaseous reactants do not rise too rapidly through the molten bath and therefore escape therefrom before the reaction desired is achieved. The temperature of the molten bath is adjusted to the desired reaction temperature and is maintained at this temperature throughout the reaction.

It is possible in this manner to control the temperature of the reaction very exactly, even when the reaction carried out is highly exothermic and endothermic, as the molten bath possesses a high seat capacity. The thorough intermixture of the gaseous reactants and the molten bath constantly causes new heat exchange surfaces, and in catalytic reactions new catalytically active surfaces to be presented to the reactants.

It is necessary for the process in accordance with the present invention that the gaseous reactants are thoroughly intermixed with the molten bath in order that they remain thoroughly intermixed therewith until the desired reaction is achieved. Preferably the gaseous reactants are introduced into the melt in a finely divided condition and under such conditions that a thorough intermixture with the molten bath is achieved. In some instances it is desirable to enhance the agitating effect obtained by introducing an excess of one of the gaseous reactants or by introducing inert gases such as, for example, carbon dioxide, steam and the like, into the molten bath simultaneously with the gaseous reactants. The gaseous reactants are preferably introduced near the bottom of the molten bath, and the depth of the molten bath is selected so that the desired reaction is completed before the reactants escape therefrom. Preferably, also, the reaction product as well as any unreacted reaction participants escaping from the molten bath are immediately cooled down to prevent undesirable reactions from taking place outside of the molten bath.

The process in accordance with the present invention is especially well suited for carrying out numerous types of reactions, such as, for example, hydration, dehydration, hydrogenation, dehydrogenation, oxidation, dissociation, polymerization and the like reactions. The present process is suitable for organic reactions in which, for example, hydrocarbons, alcohols, aldehydes, carboxylic acids, ketones, phenols, amines, may serve as gaseous reactants; and for reactions of inorganic nature, for instance, the production of hydrocyanic acid from carbon monoxide and ammonia or the production of sulfur trioxide from sulfur dioxide and oxygen.

Thorough investigations have shown that a considerable number of substances may be employed for the preparation of the molten baths employed in accordance with the present invention for example, nitrates, nitrites, chromates, acetates, chlorides, bromides, cyanides, cyanates, oxides, hydroxides, sulfates of alkali metals, alkaline earth metals, earth metals such as sodium, potassium, calcium, barium, aluminum and cerium. Furthermore, carbonates, phosphates, borates, silicates, glass or silica and organic compounds having high melting and boiling points such as urea, paraffin, naphthalene, decahydronaphthalene, halogenated naphthalenes, diphenyloxide, nitrobenzene and the like may be employed for the preparation of the molten baths.

These compounds and substances may be employed either alone or in combination with each other. It has usually been found advantageous to combine several of the substances or compounds to form a mixture which is especially suitable for the desired reaction. Generally the composition of the molten bath is selected so that the temperature necessary for the desired reaction is approximately midway between the boiling point and the solidification point of the bath.

The following compositions have been found especially suitable for the molten baths. The temperatures recited are those for which the compositions are most suited. Of course, such baths are also desirable for reactions carried out at temperatures approximating these temperatures:

I. Nitrates

	°C.
30% KNO_3+70% $LiNO_3$	130
55% KNO_3+45% $NaNO_3$	218
50% KNO_3+50% $NaNO_3$	140
50% $NaNO_3$+50% $NaNO_2$	220

II. Chlorides

a

31% $BaCl_2$+48% $CaCl_2$+21% NaCl	430
50% $BaCl_2$+30% KCl+20% NaCl	540

b. Chlorides+carbonates

50% KCl+50% Na_2CO_3	560

c. Chlorides+fluorides

85% $CaCl_2$+15% CaF_2	645

d. Chlorides+sulfates

35% NaCl+65% Na_2SO_4	620

e. Chlorides+phosphates

50% Na_3PO_4+50% KCl	680

f. Chlorides+borates

88% $BaCl_2$+7% $Na_2B_4O_7$+5% MgO	980

g. Chlorides+carbonates+sulfates

40% NaCl+20% Na_2CO_3+40% Na_2SO_4	500

III. Chromates

50% $K_2Cr_2O_7$+50% $Na_2Cr_2O_7$	300

IV. Sulfates

25% K_2SO_4+75% Na_2SO_4	830

V. Phosphates

70% $Na_4P_2O_7$+30% $K_4P_2O_7$	875
44% $K_4P_2O_7$+56% KPO_4	615

VI. Silicates

45% $BaSiO_3$+55% Na_2SiO_3	905

VII. Borates

50% $NaBo_2$+50% $LiBO_2$	648

VIII. Bromides

50% KBr+50% NaBr	640

The molten baths employed in accordance with the present invention are maintained at the desired temperature by suitable heat exchange means. If the reaction being carried out is of endothermic nature, it is necessary to supply heat to the molten bath in order that the desired temperature be maintained for the reaction. This is preferably accomplished by internal heating of the molten bath. However, external heating may also be employed.

It has been found advantageous to employ flues or dipping burners for internal heating, the flues or burners preferably being arranged in a chamber adjacent to the reaction chamber so that the combustion gases do not mix with the reaction products. The molten baths may also be heated electrically, for example, by electric resistance heating or, if the bath is an electrolyte, by electrodes dipped therein. Also, in some instances it is possible to introduce the necessary heat into the molten bath by preheating the gaseous reaction compounds which are introduced or by introducing preheated inert gases into the molten bath. It is sometimes advantageous to combine various heating means, for example, employing dipping burners as the main supply of heat for the molten bath and employing electrode heating to effect fine adjustment of the molten bath to the desired temperatures.

If the desired reaction is exothermic, it will be necessary that the heat liberated within the molten bath be withdrawn by suitable cooling surfaces.

Both in exothermic and endothermic reactions the temperature of the molten bath may easily be controlled thermostatically.

If the heating of the molten bath is effected with electrodes, the latter may also act catalytically or otherwise favorably affect the reaction. It has, for example, been found especially advantageous to employ graphite electrodes for heating the fused salt bath employed in the production of hydrocyanic acid from ammonia and carbon monoxide, as such electrodes deliver carbon monoxide as well as remove the undesired oxygen from the molten bath.

As has already been mentioned, the molten baths per se may serve as catalysts for the reaction carried out therein or they may contain suspended catalytic material. Certain oxidizing reactions may be improved by introducing boric acid, borates or barium compounds into the molten bath. On the other hand, catalytic materials which are insoluble in the molten bath may also be employed. Such insoluble catalysts are suspended within the molten bath in extremely finely powdered condition. Such catalysts which either tend to float or sink in the molten bath may be precipitated upon suitable solid carriers in order that the density of the composite catalytic material approximates that of the molten bath.

Various elements and compounds such as, for example, metals, metal compounds, earth acids or salts may be employed as catalysts. In hydrogenation reactions the usual hydrogenation catalysts may be employed such as nickel, iron, molybdenum, tungsten and zinc oxide. For oxidation reactions various known oxidation catlysts may be employed, for example, iron oxide and vanadic acid. Such dehydration catalysts as aluminum oxide, titanium dioxide, alkaline earth phosphates may be employed in facilitating dehydration reactions.

If the catalyst desired tends to sink in the molten bath employed, it may be deposited upon a light carrier, such as aluminum oxide, voluminous or active silica, asbestos, magnesium oxide, beryllium oxide, charcoal or activated charcoal. If the desired catalyst tends to float, it may be combined with relatively heavier carriers, for instance, heavy metals such as tungsten, copper and the like.

The process in accordance with the present invention is especially well suited for carrying through reactions which require high temperatures as well as for reactions which require that a constant temperature be maintained such as, for example, in the production of acetylene or ethylene from methane. The process in accordance with the present invention is furthermore especially well suited for carrying out partial oxidation reactions, such as, for example, the production of phthalic acid or maleinic acid by the partial oxidation of aromatic hydrocarbons and the production of carboxylic acids, ketones, aldehydes or alcohols by the partial oxidation of methane or its homologues.

The process in accordance with the present invention may be carried out at normal, reduced or increased pressures, depending upon the requirements of the reaction carried out.

If substantial portions of the fused material of the molten bath are carried off in vapor form or as a mist together with the reaction products, these may be recovered in an absorption chamber.

The molten baths as well as catalysts contained therein may be easily regenerated during the process by passing a portion of the melt as well as any catalyst contained therein into a chamber adjacent to the reaction chamber wherein they may be subjected to a regenerating treatment, for example, with the aid of steam or oxidizing gases. Such regeneration treatment may be carried out continuously without interrupting the reaction carried out in the reaction chamber.

The following examples will serve to illustrate the present invention, but it is to be understood that the invention is in no way limited thereto.

Example I

For the production of sulfur trioxide, dry roaster gases from pyrite furnaces containing about 7% of sulfur dioxide are introduced tangentially and counter-currently with an excess of air into a molten bath of 31 parts of barium chloride, 48 parts of calcium chloride and 21 parts of sodium chloride containing suspended silver vanadate as a catalyst. The molten bath is maintained at 480° C. by suitable heat exchange means.

The formation of sulfur trioxide is accompanied by a considerable evolution of heat and, at the same time, sulfur trioxide will decompose to sulfur dioxide and oxygen at temperatures above 430° C. The use of a molten salt bath for the reaction is therefore of considerable importance as it is possible to regulate the temperature of the reaction within the molten bath very exactly. The yield of sulfur trioxide is at least 75% of the theoretical

Example II

For the production of phthalic acid, naphthalene and an excess of air are injected into a molten bath of 31 parts barium chloride, 48 parts calcium chloride and 21 parts sodium chloride, in which vanadium pentoxide is suspended as a catalyst. The temperature of the molten bath is maintained at 480° C. The reaction product is rapidly cooled after egress from the molten bath, and phthalic acid is obtained in a yield of at least 90% of the theoretical.

Example III

For the production of formaldehyde, air and an excess of methane are injected together with nitrous oxide gases in a proportion of 1 part nitrous oxide gases to 10 parts methane into a molten bath containing 50 parts $NaBO_2$ and 50 parts $LiBO_2$. The molten bath is maintained at 700° C. After egress from the melt, the reaction gases are passed into water whereby a formaldehyde yield of at least 70% of the theoretical calculated with reference to methane is obtained.

WALTER BECK.
HANS WALTER.
KLAUS BONATH.

Published July 13, 1943 Serial No. 395,497

ALIEN PROPERTY CUSTODIAN

FROTH FLOTATION PROCESS

Karl Wiesler, Frankfurt (Main), Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 27, 1941

The present invention relates to the production of an improved froth flotation agent for concentrating ores and the like and to a method for the concentration of ores and like materials with such improved flotation agent.

It is an object of the present invention to provide a froth flotation agent of high efficiency from the less efficient turpentines.

The present application is a continuation-in-part of my co-pending application S. N. 194,207, filed March 5, 1938.

In froth flotation processes finely ground crude ores are agitated in a liquid bath such as water, containing flotation agents (foaming agents) by the introduction of a finely divided current of a gas such as air. Concentrated ore adheres to the foam which is formed at the top of the liquid bath whereas the gangue remains at the bottom of the flotation vessel. The results obtained in such a flotation process depend on the efficiency of the froth flotation agent employed.

Pine oil has been employed for many years as a flotation agent for the concentration of ores, whereas turpentines have proved to be very poor flotation agents.

It has now been discovered, in accordance with the present invention, that very excellent froth flotation agents may be prepared from turpentines by hydration thereof such as, for example, by treatment with acids or acid anhydrides and subsequent hydrolysation of the reaction product.

The starting materials employed in accordance with the present invention are turpentine products such as those obtained at lower temperatures in the steam distillation or extraction of pine wood, the dry distillation of certain pine woods, balsam turpentine or spirits of turpentine, and especially sulfate turpentine which is obtained as a by-product in the production of wood pulp from terpene-containing pine wood by the sulfate process.

These crude turpentine products may, for example, be treated in accordance with the present invention with HCl until no more of the HCl is taken up. The resultant product is then hydrolysed by heating with water or dilute aqueous alkaline solutions. The hydrolysed product is then purified, for example, by fractional distillation and forms an excellent flotation agent. If desired, this product may be improved by fractionation and recovery of the fraction boiling above about 200° C., especially a fraction boiling between 200° C. and 220° C.

Instead of hydrogen chloride, other acid materials may be employed, for example, sulfuric acid or acetic anhydride, in the presence of a small quantity of sulfuric acid. It is also possible to reflux turpentine with twice its volume of 20% sulfuric acid whereby the desired hydration takes place directly without a supplemental hydrolization step.

The following example serves to illustrate a mode for the preparation of an improved flotation agent from turpentine.

Example

Hydrogen chloride is bubbled through crude turpentine obtained by the dry distillation of conifer wood at normal or slightly raised temperatures until no more hydrogen chloride is taken up by the turpentine. This treatment requires approximately two to three hours.

The reaction mixture thus obtained is mixed with about an equal volume of water or a dilute aqueous alkaline solution such as a dilute solution of sodium carbonate. This mixture is then refluxed for about four hours whereby the hydrogen chloride taken up by the turpentine is hydrolysed.

The hydrated product is separated from the aqueous layer by decanting or extraction with ether and then dried with dehydrated sodium sulphate and fractionated.

The hydrated reaction product is obtained in a yield of 85% to 90% and is an excellent froth flotation agent.

Instead of turpentine obtained by the dry distillation of wood turpentine from other sources such as, for example, sulphate turpentine may be treated in an analogous manner to produce an excellent flotation agent.

When employing the hydrated turpentine products obtained in accordance with the present invention as the froth flotation agent in known flotation processes for concentrating ores and like materials, excellent stable homogeneous foams are produced which possess a good concentrating effect.

KARL WIESLER.

Published July 13, 1943

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ALIEN PROPERTY CUSTODIAN

FROTH FLOTATION PROCESS

Karl Wiesler, Frankfurt (Main), Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 27, 1941

The present invention relates to the production of an improved froth flotation agent for concentrating ores and the like and to a method for the concentration of ores and like materials with such improved flotation agent.

It is an object of the present invention to provide a froth flotation agent of high efficiency from the less efficient turpentines.

The present application is a continuation-in-part of my co-pending application S. N. 194,207, filed March 5, 1938.

In froth flotation processes finely ground crude ores are agitated in a liquid bath, such as water, containing flotation agents (foaming agents) by the introduction of a finely divided current of a gas such as air. The concentrated ore adheres to the foam which is formed at the top of the liquid bath whereas the gangue remains at the bottom of the flotation vessel. The results obtained in such a flotation process depend on the efficiency of the froth flotation agent employed.

It has now been discovered that very excellent flotation agents may be prepared from turpentines by an oxidation process, preferably with molecular oxygen at elevated temperatures.

The starting materials employed in accordance with the present invention are turpentine products such as those obtained at lower temperattures in the steam distillation or extraction of pine wood, the dry distillation of certain pine woods, balsam turpentime or spirits of turpentine, and especially sulfate turpentine which is obtained as a by-product in the production of wood pulp from terpene-containing pine wood by the sulfate process.

Preferably small quantities of water should be present during the oxidation with gaseous oxygen. This causes a certain foaming effect during the oxidation which increases the efficiency of the oxygen because of its consequent fine distribution through the turpentine.

Instead of employing oxygen for the partial oxidation of turpentine, in accordance with the present invention it is also possible to employ materials which split off oxygen, for example, ozone, hydrogen peroxide, persulfate salts and the like.

The partially oxidized products obtained in accordance with the present invention show greatly improved flotation properties over the corresponding untreated turpentine products. Such partially oxidized turpentine products have an increased alcohol content ranging between 20% and 60% and an increased ester content ranging between 2% and 20%.

It is also possible in accordance with the present invention to improve the partially oxidized turpentine products by subjecting such products to a hydrating or hydrolysing treatment. For example, the oxidized product is treated with hydrogen chloride until no further hydrogen chloride is taken up and this product is then hydrolysed by refluxing with water or dilute aqueous alkaline solutions. The resulting product is then preferably purified by steam distillation.

If desired, the resulting product may be improved further by fractionation and recovery of the higher boiling fractions, for example, the fraction boiling above about 200° C.

The following example serves to illustrate the present invention, but it is to be understood that the invention is in no way limited thereto:

Example

Finely distributed oxygen was introduced into 1000 gr. of Finland crude sulfate turpentine (density .865, terpineol content 3.8%, ester content as terpineol formate 0.2%) through a filter plate while heating the turpentine to 100° C. in a heating bath. After eight hours' treatment a product of the following qualities was obtained:

Density		0.9751
Alcohol content	per cent	24.5
Ester content	do	7.7

It was found that only four drops of this resulting oil were necessary to produce a highly stable foam in an ore flotation process whereas not even a homogeneous foam was obtained when employing nineteen drops of the crude, unheated product.

Instead of sulfate turpentine, turpentine from other sources, such as, for example, balsam turpentine, or turpentine obtained in the steam or dry distillation of wood as the lower boiling fraction, may be employed.

KARL WIESLER.

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ALIEN PROPERTY CUSTODIAN

FROTH FLOTATION PROCESS

Karl Wiesler, Frankfurt (Main), Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 27, 1941

The present invention relates to the production of an improved froth flotation agent for concentrating ores and the like and to a method for the concentration of ores and like materials with such improved flotation agent.

It is an object of the present invention to provide a froth flotation agent of high efficiency from the less efficient turpentines.

The present application is a continuation-in-part of my co-pending application S. N. 194,207, filed March 5, 1938.

In froth flotation processes finely ground crude ores are agitated in a liquid bath, such as water, containing flotation agents (foaming agents) by the introduction of a finely divided current of a gas, such as air. The concentrated ore adheres to the foam which is formed at the top of the liquid bath, whereas the gangue remains at the bottom of the flotation vessel. The results obtained in such a flotation process depend on the efficiency of the froth flotation agent employed.

Pine oil has been employed for many years as a flotation agent for the concentration of ores, whereas turpentines have proved to be very poor flotation agents.

It has now been discovered that, in accordance with the present invention, very excellent froth flotation agents may be prepared from crude turpentine by reacting the crude turpentine products with aldehydes, preferably formaldehyde. This reaction may be effected by heating the reaction components at ordinary or elevated pressure and in the presence or absence of a catalyst.

The starting materials employed in accordance with the present invention are turpentine products such as those obtained at lower temperatures in the steam distillation of or extraction of pine wood, the dry distillation of certain pine woods, balsam turpentine or spirits of turpentine, and especially sulfate turpentine which is obtained as a by-product in the production of wood pulp from terpene-containing pine wood by the sulfate process.

Besides formaldehyde and, of course, its polymerization product, paraformaldehyde, other aldehydes may be employed in accordance with the present invention, such as Furfural, benzoldehyde.

The following examples serve to illustrate a mode for the preparation of an improved flotation agent from turpentine:

Example I

A mixture of 100 grams crude sulfate turpentine and 22 grams paraformaldehyde (polymerized formaldehyde) were heated in the presence of 100 grams glacial acetic acid at temperatures ranging between 100° C. and 150° C. After 25 hours' heating, the solution was extracted with ether. The ether fraction was then washed with water and sodium bicarbonate and subsequently dried. After distilling off the ether, 148 grams of oil were obtained as a residue. This oil was then treated with potassium hydroxide to effect saponification thereof. The saponified product was then dissolved in ether, the ether distilled off and the residue fractionated. The fraction boiling between 225° C. and 240° C., as well as the fraction boiling between 240° C. and 270° C., proved excellent flotation agents producing good yields and dense foams.

Example II

Turpentine is reacted with formaldehyde under pressure by heating a mixture thereof in alkaline solution in a closed tube for several hours at a temperature between 150° C. and 200° C. The resulting oily reaction product which is obtained has a boiling point range above 200° C. and is well adapted as a froth flotation agent.

KARL WIESLER.

Published July 13, 1943

Serial No. 401,522

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF POROUS MATERIAL

Josef Schneider, Oberursel (Taunus), Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 8, 1941

My invention relates to a process for the production of porous products from fibrous material, particularly for isolating purposes.

Hitherto it was already known to produce materials with a porous structure for building purposes by gas generating of a paste consisting of hydraulically binding substances such as concrete, gypsum and the like and water, and if desired, with addition of a filling material, e. g. sand.

Now I have found that high grade, extraordinarily light products with an excellent isolating effect with respect to heat and sound may be obtained if an aqueous pulp of fibrous material such as straw, wood pulp, peat, asbestos is raised with gas generating substances, for instance, peroxygen compounds. The gas generation of the mass may begin according to the moment of addition of the gas generating medium, for instance, hydrogen peroxide, and the decomposition catalysts such as manganese sulfate, either already during the mixing operation and/or after the casting of the pulp into the forms. The raised and formed products are then dried. Instead of peroxygen compounds also other gas evolving substances such as ammonium carbonate or metals in combination with an acid or an alkali may be used.

It was not to be foreseen that the present invention would warrant an uniform raising process without an escape of the greater part of the gases evolved in the pulp. Furthermore, it could not be predicted that the products made according to my invention would have a sufficient solidity and strength. Contrary to all expectations, however, the process of my invention yields to products with uniform regulable and reproducible porosities. I have observed that during the raising process according to the kind of fibres used, a more or less distinct felting of the fibres takes place whereby, also in absence of any binding material, the escape of the gases evolved in the mass is prevented or rendered difficult whilst the agglomeration and consequently the mechanical strength is considerably increased.

To favor the raising effect all known means may be employed. Thus, for instance, substances may be added to regulate the size and stabilization of the pores, i. e. substances which reduce the surface tension. Such substances are, for instance, saponine, wetting agents such as Igepon or other colloids. Good results were also obtained with an addition of milk. The amount of such additions may be insignificant, for instance, below 1% up to a few percents based on the mass of the pulp to be treated. In using peroxygen compounds as raising media, the decomposition catalysts, for instance, manganese sulfate and ammonia may be introduced by stirring, preferably after homogenisation of the paste, whereupon the evolution of gas begins. Furthermore, hypochlorites may be added besides the peroxygen compounds; both these substances react with each other evolving oxygen.

Sometimes I have found it expedient to employ a mixture of various fibrous materials, for instance, of high grade and low grade material, long and short fibrous material or the like. Also non fibrous filling material may be added. Moreover, it is possible to influence the properties of the porous mass in a definite direction by other additions, as, for instance, by substances which reduce the combustibility. If specially elastic masses are required, additions of caoutchouc have proved advantageous for purposes which need an extremely high mechanical stress, for instance, pressure or bending, stiffening substances such as pitch, bitumen, artificial resins and the like may be added in moderate quantities, preferably during the preparation of the pulp. The final products may also be impregnated with the aforementioned or other substances in order to confer special qualities to the porous material.

As an illustration of my invention the following examples are given:

1. 65 grs opened straw cardboard are mixed with 575 cc water whereupon 50 mgrs manganese sulfate and 7 cc of hydrogen peroxide 40 Vol.% are added. After careful homogenisation 12 cc concentrated ammonia are introduced whilst stirring, involving the raising of the pulp. The pulp is filled into the forms where the gas generation is finished. The subsequent drying is carried out at slowly increasing temperatures of about 60 to 140° C. The final mass has a specific gravity of 0,09 and shows besides good solidity excellent isolating qualities, for instance, with respect to sound and heat.

2. 65 grs straw stuff are introduced in 325 cc water to form a pulp whereupon 75 cc hydrogen peroxide 40 Vol.% containing 0,9 g dissolved saponine are added. The whole pulp is thoroughly mixed and 1 g pyrolusite added as decomposition catalyst. The further working up is carried out according to Example 1. The product obtained has a specific gravity of 0,08, a uniform vesicular structure and shows a good felting.

3. From 50 g asbestos fibres (length 3 to 5 cm), 475 cc water with 50 mgrs dissolved manganese sulfate and 7,0 cc hydrogen peroxide 40 Vol.%

and 1 g dissolved saponine a homogeneous mixture is prepared. 12 cc of concentrated ammonia are admixed and the pulp worked up according to Example 1. The thus obtained product is extremely well suited for heat isolating purposes at higher temperatures.

The products which are obtained according to my invention allow a manifold utilization, especially in cases where a low weight and/or good isolation is desired, as for instance, in the builder's trade and for isolation against sound and heat. Since it is possible to keep the specific gravity of these new products below the specific gravity of cork and since it is also possible to assimilate the properties of the new product with those of cork, the new products may replace the use oi cork in numerous cases.

JOSEF SCHNEIDER.

Published July 13, 1943 Serial No. 401,673

ALIEN PROPERTY CUSTODIAN

FELTING PROPERTY OF DYED SHODDY

Egon Elöd, Heidelberg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 9, 1941

My invention relates to a process for an improvement in the felting property of dyed shoddy by subjecting the shoddy to a treatment with acid and at the same time oxidising carrots, particularly carrots containing nitric acid and oxidising agents such as cerium nitrate, alkali tungstenate, ferric nitrate or hydrogen peroxide in aqueous solutions.

Dyed shoddy, especially when dyed with acid or substantive dyestuffs, show a bad, sometimes even very bad felting property. Thorough investigations have shown that the felting property of such shoddy may be improved considerably by subjecting it to a carroting treatment with acid and at the same time oxidising substances.

In carrying out my invention carrots have proved suitable which contain nitric acid and oxidising agents acting also as oxidation catalysts such as cerium nitrate, alkali tungstenate, ferric nitrate or, if desired or necessary, also other oxidising agents, for instance, hydrogen peroxide in aqueous solutions.

The acid concentration of the carrots is rated in such manner that the pH value of the carroted shoddy lies between about 2.1 and 2.7, preferably between about 2.1 and 2.5.

It was already known to carrot crude wool with acid solutions containing oxidising substances to attain a proteolytic splitting up which improves the felting property of the wool. It was impossible to foresee that the treatment of dyed shoddy with such carrots would yield to an improvement with respect to the felting property of such material since the shoddy has formerly already been subjected to a proteolytic splitting up, for instance, by dyeing, wet dyeing or the like. Moreover, considerable competent objections have been raised against the carroting of dyed shoddy as this material has been subjected to a heavy damage caused by the dyeing, use and tearing and would therefore not be able to stand also a further carroting process.

Now it was surprisingly found that dyed shoddy which according to my invention has been treated with acid oxidising carrots has a substantially improved felting property and results in thicker felts with remarkably improved qualities, especially increased mechanical strength, particularly tensile strength. The surprising effect of the carroting is obviously due to the fact that the peptide groups—CO—NH—contained in the wool fibres are split up by the carroting action and liberate basic amino groups which favor the plastic swelling in the felting process. Consequently the carroting has to be carried out in such manner that the peptide groups are split up sufficiently or nearly sufficiently in order to obtain products the pH value of which lies in the above mentioned area. Experiments have shown that ready carroted shoddy with a pH value below or even far below 2.1 undergoes a harmful influence in view to its tensile strength, whilst products with a pH value above 2.7 show an insufficient carroting effect.

Should the thus treated shoddy show a pH value just above 2.7, it may be adjusted to a pH of 2.3 by an after treatment with acid substances, for instance, by spraying with warm sulfuric acid solutions.

The carroting process may be carried out according to the known methods, for instance, in such manner that the shoddy is immersed in the aqueous carrot or sprayed with it whereby the excess of the carroting liquid is removed by centrifuging or squeezing. According to my invention the shoddy may also be treated by spraying with a definite quantity of carrot only without subsequent squeezing or centrifuging. I have found that rinsing decreases or even eliminates the carroting effect and should therefore be strictly avoided.

The carroted material is allowed to stand for about two hours at ordinary temperature. The subsequent drying is carried out expediently at moderately elevated temperatures, for instance, at about 50°–60° C.

The carroted shoddy may be mixed with other fibrous materials, for instance, not carroted undyed wool or with carroted hairs and then felted or fulled. The carroting of the shoddy may be carried out also in mixture with other fibrous materials. This may be done, for instance, by subjecting mixtures of shoddy and coarse undyed wool to a carroting process and working up of the carroted mixtures as usual. The felting and fulling is advantageously carried out in an acid area.

The definition of the pH value of the carroted shoddy may be ascertained as follows:

1 g of an average sample is extracted with 30 cc of distilled water during one hour on the water

bath and the pH value of the clear liquid determined according to the known methods. As a state of equilibrium will be obtained during the extraction process, the pH value of the clear liquid corresponds exactly to that of the carroted shoddy.

Example 1

Dyed shoddy is immersed and homogeneously soaked in an aqueous solution containing 5% hydrogen peroxide (40 Vol. %), 0.5% cerium nitrate and 3% nitric acid (65%) whereafter the excessive liquid is removed by centrifuging. The good is then allowed to stand for a time of about 2 hours at ordinary temperature and is subsequently dried at a temperature of about 50–60° C. The carroted shoddy is mixed with other fibre material, for instance with uncarroted and undyed wool and felted and fulled in an acid area according to known methods. The thus obtained felts are especially suited in the manufacture of hats.

Example 2

Dyed shoddy is sprayed with an aqueous solution consisting of 7% hydrogen peroxide (40 Vol. %), 1.5% ferric nitrate and 5% nitric acid (65%). The excess liquid · is eliminated by squeezing and then the good is allowed to stand for nearly two hours at ordinary temperature and afterwards dried at a temperature of about 50–60° C. The thus treated shoddy may be mixed with other fibres and worked up as mixed material. The felting and fulling is preferably carried out in an acid area.

EGON ELÖD.

Published July 13, 1943

Serial No. 404,522

ALIEN PROPERTY CUSTODIAN

AROMATIC ETHERS OF 1.3-BUTADIENE-OL-2

Arthur Wolfram, Frankfurt am Main, and Hellmuth Jahn, Beuthen O/S., Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 29, 1941

The present invention relates to aromatic ethers of 1.3-butadiene-ol-2.

We have found that at low temperature there occurs in the presence of mercury salts an addition of monovinyl acetylene on aromatic hydroxy bodies. The aromatic ethers of 1.3-butadiene-ol-2 are formed according to the equation:

$$Ar.OH+HC{\equiv}C{-}CH{=}CH_2 \longrightarrow H_2C{=}\underset{\displaystyle |\atop \displaystyle O{-}Ar}{C}{-}CH{=}CH_2$$

wherein Ar stands for an aromatic radical.

The constitution was rendered probable by the fact that the compounds obtained are, by the addition of dilute sulfuric acid, split into vinylmethylketone and the aromatic hydroxy bodies. The vinylmethylketone could easily be detected by its reaction with phenylhydrazine so as to form methyl-3-phenyl-1-pyrazoline.

The reaction temperatures for the addition of acetylene on the aromatic hydroxy bodies are suitably at about 0° C. As aromatic hydroxy bodies, there may be named: the phenols, the homologues and substitution products thereof, such as for instance: ortho-cresol, meta-cresol and para-cresol; the xylenols; ortho-, meta- and para-chlorophenol; ortho-, meta- and para-bromophenol, the ethyl-phenols as well as phenols substituted in the nucleus by higher alkyl radicals such as butyl, isobutyl and amyl.

The reaction may also be carried out in diluents, for instance in ethers, dioxane, pyridine or the like. As catalyst, mercuric oxide has proved to be best; it may be used several times. The yields are good. By-products were not observed.

As the new compounds are very polymerizable, it is suitable to work in the presence of stabilizing agents, because otherwise part of the ethers polymerizes during the further treatment. Because of their polymerizing power the aromatic ethers of 1.3-butadiene-ol-2 may be used as intermediate products for the preparation of plastics.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto, the parts being by weight:

(1) Monovinyl acetylene is introduced in excess at −5° C. to 0° C., while stirring, into a mixture of 940 parts of phenol, 250 parts of ethyl ether and 70 parts of mercuric oxide to which there are added 4 parts of thiodiphenyl amine as stabilizing agent. The reaction mass is rendered alkaline, while cooling with ice, and subjected to steam distillation. The ether layer is separated from the water, the whole is dried over sodium sulfate and the ethyl ether is removed. The residue is distilled under reduced pressure. After a slight first running the phenyl ether of 1.3-butadiene-ol-2 passes over at 65° C. to 66° C. under 3 mm. pressure in the form of a colorless oil. The ether is distinguished by an aromatic smell which is not disagreeable.

(2) A mixture of 880 parts of m-cresol, 100 parts of ethyl ether, 100 parts of mercuric oxide and 4 parts of thiodiphenylamine is cooled to 0° C. and saturated at this temperature with monovinyl acetylene, while vigorously stirring. The product is worked up as described in Example 1. The m-cresyl ether of the 1.3-butadiene-ol-2 passes over under a pressure of 2 mm. of mercury at 71° C. to 72° C. in the form of a colorless liquid, which likewise has a special smell. The yield amounts to about 1000 parts.

(3) Monovinyl acetylene is introduced at 0° C. into a mixture of 500 parts of meta-chlorophenol, 100 parts of ethyl ether, 100 parts of mercuric oxide and 4 parts of thiodiphenyl amine, while stirring until the solution is saturated. The reaction product is worked up according to Example 1; the meta-chlorophenyl ether of 1.3-butadiene-ol-2 is obtained which under 3 mm. pressure has a boiling point of 81° C. and becomes yellowish when exposed to the air. This ether has also an aromatic smell.

ARTHUR WOLFRAM.
HELLMUTH JAHN.

Published July 13, 1943 Serial No. 420,578

ALIEN PROPERTY CUSTODIAN

LIGHT AND ULTRA-LIGHT ALLOYS AND THE METHODS OF THEIR MANUFACTURE

Louis Henri François Canac and Emile Auguste Marie Antoine Segol, Toulon (Var), France; vested in the Alien Property Custodian

No Drawing. Application filed November 26, 1941

Our invention relates to ultra-light alloys containing aluminium and magnesium, the proportion of magnesium being greater than 50%. More particularly it relates to aluminium-magnesium base alloys and a method of making the same whereby certain desirable properties in such alloys are assured. This application is a third continuation-in-part of our application Serial No. 150,880, filed June 28, 1937; a first continuation-in-part having been filed June 19th, 1939, with Serial No. 279,992, and a second continuation-in-part May 13th, 1940, with Serial No. 334,936.

The principal object of the invention resides in the provision of a self-protecting film on the surface of the alloy which guards the alloy from corrosion in sea water and the like. This film has the remarkable capacity of cicatrizing. That is, if the film is fractured or broken, this fracture is immediately closed up or "healed" by the automatic formation of a protective scar.

Ordinary aluminium-magnesium base alloys heretofore known do not possess this remarkable property. While some of the literature has given examples of aluminium-magnesium base alloys which are resistant to corrosion, no example has been disclosed of an alloy having a self-healing protective film, and no disclosure, of which we are aware, has in any way taught how an alloy having such a remarkable property can be produced particularly with any degree of assurance.

The invention is based on a remarkable discovery we have made after many experiments and is based on a new principle.

According to this new principle and discovery, an alloy is formed of aluminium and magnesium, and by utilizing predetermined proportions of these base metals, and by adding one or more other metals which meet very rigid requirements as to amounts and properties, there is automatically formed on the surface of the alloy a uniform adherent, leak-proof, protective film which possesses the astounding property of cicartrizing (forming a scar, healing, closing up) immediately after fracture.

It is consequently the principal object of our invention to provide such an alloy and a method whereby it may be produced, not haphazardly and perchance occasionally, but every time the dictates of the following specification are followed.

A more specific object of the invention is the provision of an alloy having a self-protective and self-healing film and having a finely heterogeneous, approximately eutectic structure which, when certain requisites of the invention are carried out, results in the formation of a multitude of galvanic couples. These galvanic couples, being finely distributed, assure the rapid formation of the protective film in the presence of a normally corrosive agent such as sea water.

As already indicated the results desired can only be obtained by rigidly observing certain requisites. Particularly these requisites will now be described.

The alloy has a base of aluminium and magnesium. These base metals should be employed only in an extremely pure state. Impurities should be avoided and in any case should be less than 0.10%. This is particularly so of iron and silicon whose presence is exceptionally undesirable and even fatal to the results desired.

The proportion of magnesium can be chosen between 50% and 99%. It has been found that the best proportions are comprised between 85% and 96% preferably 90%.

An alloy containing only aluminium and magnesium, even with the proportions given above, will not give the results of the present invention. In addition to these metals, in the proportions set forth, we have found that the invention can only be carried out by carefully selecting and adding an additional metal or metals in accordance with specific requirements.

The additional metal must first of all be easily oxidizable.

Secondly, the additional metal should be more precious than the base metals. Any other metal not responding to these conditions should be excluded as an impurity inconsistent with the object desired.

The oxidizing property of the addition metal acts primarily in the electrolytic formation of unattackable oxides or oxychlorides, which make up the protective self-healing film. This, however, is only produced by galvanic couples formed between the addition metal and the base metals and in which the ions are displaced from the particles of the addition metal by the base metal. Hence, the requirement that the addition metal should be more precious than the base metals aluminium and magnesium.

When mention is made herein of metals which are more precious than the base metals, reference is had to the electromotive series which lists the metals with respect to their axtivity, that is, the ease with which they give up electrons. In general, as is well known, each metal displaces the ions of those which follow it in the list.

Another requirement of the addition metal is that it must be capable of forming a eutectic with at least one of the base metals and should

be present in an amount which preferably will approximate the amount which will form a eutectic with the base metals. This contributes to assure a fine distribution of the metals and gives rise to a great number of elementary piles between which electrolytic action is exerted to a maximum when the alloy is exposed to the action of a corrosive agent such as salt water.

The term eutectic is a definite term known to those skilled in metallurgy. The kinds of metals and the amounts thereof which will form a eutectic with another metal can, of course, be determined from phase diagrams in the technical literature.

When we say that the addition metal should be capable of forming a eutectic mixture with at least one of the basic constituents aluminium and magnesium, and that such addition metal should be present in an amount approximating the amount required to form a eutectic mixture, we intend to cover slight variations. We have found that if the addition metal is present in amounts within -30 to $+30$ of the eutectic amount satisfactory results can be obtained.

Any metals which do not meet these requirements are to be excluded, and insofar as this invention is concerned such other metals should be regarded as impurities.

While there are several metals which meet the requirements for the addition metal given above and which can be used in accordance with the invention, we prefer zirconium as the addition metal; but other addition metal or metals may be added, the latter being taken, for instance, among the following: antimony, chromium, cobalt, beryllium, manganese, titanium, cadmium, nickel, boron, bismuth, molybdenum.

Insofar as zirconium is concerned, this should be added in amounts ranging from 0.05 to 0.2%, preferably 0.18%, to obtain the best results, although amounts up to 2% may be used with the desired results. The lower and upper limits for zirconium are respectively 0.01% and 3%.

As specific examples of the invention, a satisfactory alloy can be made with:

Magnesium, more than 50%.
Zirconium, 0.2%.
Aluminium, the remainder.

Are to be considered as preferred alloys the following:

Magnesium, within 85% to 96%.
Zirconium, up to 2%, preferably 0.2%.
Aluminium, the remainder.

As for other addition metals, it is preferable, but not necessary, to add them in proportions approximating those corresponding to the eutectic points formed by these addition metals with the base metals. These proportions are well known to those skilled in the art, and as has been indicated, can be obtained from phase diagrams in the technical literature.

For example, the following table is given in which the amounts of the addition metals are the approximate values of the proportion corresponding to the eutectic of the binary diagram of aluminium and the addition metals:

	Per cent
Antimony	1.1
Chromium	0.40–0.77
Cobalt	1
Beryllium	0.90
Manganese	1.95
Titanium	0.15
Cadmium	5

As an example, we may have an alloy meeting the requirements of the invention and which consists of:

Magnesium, 85% to 96%.
Zirconium, 0.02% to 2% preferably 0.2%.
Titanium, 1%.
Aluminium, the remainder.

A preferred example using titanium is as follows:

Magnesium, 85% to 96%.
Zirconium, 0.02% to 2%.
Titanium, 0.2%.
Aluminium, the remainder.

Another example is as follows:

Magnesium, 85% to 96%.
Zirconium, 0.08% to 0.11%.
Titanium, 0.08%.
Aluminium, the remainder.

Alloys of the compositions just recited showed very good results when subjected to the action of a corrosive agent.

In all instances the surface of the alloy at the end of the period was covered with protective film. It was found that the protective self-healing film formed more rapidly where the immersion was continuous.

Mechanical properties of the alloy were found to be particularly good when the alloy is rolled. A breaking strength of 45 kg. and an elongation of the order 17% were obtained.

The titanium may be replaced by other metals provided the conditions referred to above are carried out. The following metals, for example, may be used if proportions preferably approximate the eutectic proportions, as indicated below, are observed:

	Per cent
Cr	<1
Be	<2
Mn	<3
Co	<2
Sb	<5
Ni	<5
Cd	<5

Use may also be made of the following as the fourth metal, in proportions preferably less than 1%:

Boron
Bismuth
Molybdenum

We have found that alloys produced according to the invention may be further improved by heat treatment, notably tempering. This heat treatment is designed also to improve the fineness of precipitation of the crystals formed by the addition metals as well as the so called "beta" crystals β (Al_3Mg_2).

The temperature and duration of the heat treatment depend both on the percentage of additions and the magnesium content of the alloy.

The tempering is not carried to as great a degree when the alloy has a high magnesium content, but, in each case, the duration and temperature thereof have an optimum value. It is particularly important that the duration and temperature should not be carried to coalescence of the precipitated granules.

In the case of an alloy to be rolled, the rolling operation is preferably carried out after annealing at a temperature ranging from 410 to 480° C. and cooling.

The heat treatment for giving resistance to corrosion is then carried out at a temperature

ranging from 245 to 320° C., preferably close to this last mentioned value. If it is advisable to effect a supplementary rolling operation, a new treatment is carried out at a temperature of 400° or more. In a general manner, for the alloys with which the invention is concerned the tempering should be used if the ingot or rolled plates have been very rapidly cooled. The desired structure of the alloy may also be obtained directly by suitable slow cooling of the ingot or of the sheets during the rolling, for example, by stopping for about fifteen minutes starting from a temperature generally above 300° C., in which the granules can precipitate.

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ALIEN PROPERTY CUSTODIAN

PROCESSES FOR THE PRODUCTION OF HEAT OR COLD BY MEANS OF A THERMAL PUMP WITH PISTONS AND TO THERMAL PUMPS FOR THE WORKING OF THESE PROCESSES

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Application filed February 13, 1942

If the p, v diagram (Figure 1) of a thermal pump for non-condensing fluid is considered, it will be seen that the major part of the work brought into play is neither the one of compression represented by the mixtilinear triangle ABB′, nor the one of expansion $B_1A_1B_1'$, but the one of expulsion at high pressure $DC_1B_1B_1'$ (it is assumed on the diagram that pressure which is to be considered as ambient is the low pressure of the cylinder under consideration).

It is possible to establish a diagram in a different way by plotting as ordinates the total forces F developed on the pistons and as abscissae the corresponding strokes s of the said pistons; on Figure 2, which represents such a diagram, it has been assumed that although the stroke is the same for both the compression and the driving pistons, the cross-section of the latter is inferior to that of the former by the amount (7 to 15% according to the case) necessary in order to consider the cooling which takes place between the end of compression and the beginning of the corresponding expansion, as well as the correlative heating which takes place between the end of the expansion and the beginning of the compression. The same reference letters have been used in this diagram as in the first one for denoting the corresponding points (on the first diagram C and C_1 are in coincidence, whereas on the second it is B′ and B_1' which are in coincidence) and it will be seen that the same result is obtained.

In pumps of the usual type the compression work with transfusion ABCD is entirely supplied by the machine, and the expansion work with transfusion DC_1B_1A is entirely received; the friction losses in the guiding members of the pistons as well as the lateral friction of the latter being proportional to the sum of the absolute values of this work, whereas the work to be supplied per cycle is equal only to their difference.

The more one attempts to obtain a higher thermal efficiency by reducing the amount of cooling or heating mentioned above (by actually reducing the temperature difference), the more the above inconvenience is exaggerated. This fact may be considered to be the fundamental cause of the difficulty encountered with in the design of thermal pumps for non-condensing fluids, and the mathematical analysis shows that a useful thermal efficiency may be obtained from such a machine only under the condition that the mechanical efficiency is kept extremely high.

The present invention aims to eliminate the above inconvenience. It comprises an improved process for the production of heat or cold by means of a thermal pump which is characterized in that the compression and the expansion are localized on one stroke and the corresponding transfusion work in the inverse stroke. The present invention also comprises a thermal pump for the working of the said process, characterized in that the compression and the expansion operations of the evolutive fluids are localized on one stroke, whereas the corresponding transfusion work is localized on the inverse stroke.

The accompanying drawings show, by way of example, one embodiment of the thermal pump which the invention comprises, illustrating one way of working of the process.

Figures 1 and 2 are the two diagrams which have been discussed in the introduction.

Figure 3 schematically illustrates how things happen in the case of a thermal pump of known type, this in order to clearly demonstrate the progress achieved by the present invention.

Figures 3a and 3b are two diagrams relating to the operation of the thermal pump as per Figure 3.

Figure 4 is a diagram referring also to the case of Figure 3.

Figure 5 schematically illustrates one portion of the constructional form of the thermal pump according to the invention, which will be described below.

Figures 5a and 5b are two diagrams referring to the thermal pump as per Figure 5.

Figure 6 is another diagram referring to Figure 5, and

Figure 7 schematically illustrates the whole arrangement of compression and driving cylinders and pistons included in this embodiment.

In Figure 3, a driving piston 1 is illustrated to move in a cylinder 2 and a compression piston 3 to move in a cylinder 4, the latter being arranged in alignment with the cylinder 2. Both of the pistons under consideration are each connected by means of a rod 5 and 6 respectively to a pin 7 of a crank-arm 8 carried by a shaft 9 which is driven in the direction indicated by the arrow 10 by a motor, which is not shown in the drawing. The F, s diagram corresponding to the driving piston 3 is shown on Figure 3a, whereas Figure 3b shows the F, s diagram corresponding to the compression piston 1. The same reference letters as in Figure 2 have been used in both these figures for the corresponding points.

In order to obtain a representation of the forces acting on the articulated system of the driving

mechanism, particularly in point 7, it is suitable to plot the positive diagram as per Figure 3_b against the negative diagram as per Figure 3_a, as this has been indicated in dash-dotted lines, and to establish for every value of abscissae the algebraic sum of the ordinates. In fact, the ordinates of the diagram of Figure 3_a represent forces acting on the piston 3 in the right hand side direction, whereas the ordinates of the diagram of Figure 3_b represent forces acting on the piston 1 in the left hand side direction. The diagram of Figure 4 represents the resultant forces acting on the articulated system, and this in function of the stroke of the pistons. The positive ordinates indicated by F_D represent forces acting in the right hand side direction, and the negative ordinates indicated by F_G represent forces acting in the left hand side direction. It will be seen in Figure 4 that the positive and negative forces acting on the pistons counterbalance each other during a short period of the stroke only.

In the example of the constructional form of the thermal pump according to the invention, which is going to be described below, a pressure ratio or two has been assumed, which represents an average value and which corresponds to a volumetric ratio of about 0.6. It is understood, that these values have been chosen by way of examples and do in no way limit the scope of the invention.

Figure 7 shows the whole of two trains of three pistons each arranged symmetrically with respect to a central driving crankshaft.

The following description mentions the left side of the figure only, as the functioning of the right side is the same and homologous parts bear corresponding reference numbers. It will also be possible to follow the description of the left train of the constructional form of the pump as per Figure 7 by using the Figure 5. This train embodies the pistons 11, 12_a, 12_b and 13 mounted on the same rod. The piston 12_a, 12_b is, in fact, the equivalent of two pistons rendered integral, as both of its faces are active, as will be seen below. The pistons 11 and 12_a form the boundaries of two spaces 14, 15 separated by a fixed partition 16, whereas the pistons 12_b and 13 form the boundaries of two other spaces 17, 18 separated by a fixed partition 19.

A space 20, located at the outside extremity of the machine, is in communication with the low pressure pipe of the thermal pump; in the centre a chamber 21, forming a case, which may advantageously be connected with the low pressure pipe, contains the crank 22 (Figure 7) carried and driven by the shaft 23 and carrying on its pin 24 a ball, roller or needle bearing which rolls in a transversal slot limited by two surfaces 25, 25′ integral with the crosshead formed by the two homologous pistons 11, 11′ and guided inside the cylindrical case 26 (which may also be rectangular) by the bearings 27, 27′.

As the volumetric ratio in the present example has been chosen to be 0.6, the faces of the pistons 12_a, 12_b possess each an active surface amounting to 0.6 of that of the opposed pistons 11 and 13 respectively. As the active section of piston 11 (which, as will be seen below, is a driving piston), has to be inferior to that of piston 13 (which will be seen below, is a compression piston), the difference in surface necessary to take into account the temperature difference of the fluid in contact with the two pistons is obtained by giving to the portion 28 of the rod connecting the pistons 12_a and 11 a greater diameter than to the portion 28_a of this rod connecting the pistons 12_b and 13. If for constructional reasons the two pistons 11 and 13 should be of the same diameter, the ratios would no more be respected, but this could be remedied by suitably altering the dead spaces at the end of the stroke.

The portion 28_a of the rod connecting the pistons 12_b and 13, which is never stressed otherwise than in traction, may be of a smaller diameter without risks of buckling failure. The functioning of the portion of the thermal pump illustrated in Figure 5 is the following:

The pistons being in the middle of their stroke as shown in the drawing and the crank 22 rotating anticlockwise, the pistons shown in Figure 5 are moving towards the left. At this moment, a valve 29 permitting to establish the communication between the driving cylinders 14 and 15, is shut and interrupts this communication. The driving piston 11 which is moving in the space 14, expels at low pressure through a valve 30, whereas the driving cylinder 15 is charged with high pressure gas through a valve 31. Meanwhile a connection valve 32, provided for establishing communication between the compression cylinders 17 and 18, is shut and the compression cylinder 17 is being emptied into the high pressure pipe of the thermal pump through a valve 33, whereas the compression cylinder 18 is being filled with low-pressure gas through automatic valves 34 carried by the piston 13. When the train of pistons 11, 12_a, 12_b and 13 reaches the end of the stroke and moves back towards the right, the valves 30, 31 and 33 are shut and the flap-valve 34 shuts automatically. During this stroke, carried out in the inverse direction to the preceding, the valves 29 and 32 are open and establish a connection between the driving cylinders 14 and 15 and the compression cylinders 17 and 18 respectively; thus the gas is compressed at the left (Figure 5) in the whole space formed by the cylinders 17 and 18, whereas it simultaneously expands in the whole space formed by the two cylinders 14 and 15.

In order to properly understand the functioning of the apparatus, it is necessary to refer to the diagrams in Figures 5_a and 5_b. In these diagrams the positive ordinates F_D represent forces acting on the pistons in the right hand side direction and the negative ordinates F_G represent forces acting on the pistons in the left hand side direction, whereas the abscissae represent the piston strokes. The points of the diagrams corresponding to the position of the active surface of each piston situated exactly above these points are shown by small black circles under the assumption that the pistons are moving towards the left. The points on the same diagrams corresponding to the same position of the active surface of each piston, under the assumption that the pistons are moving towards the right, are shown by small white circles. The arrangement adopted in the diagram of Figures 5_a and 5_b results in that they represent work diagrams described in the usual direction (clockwise for a positive work and anticlockwise for a negative work). The letters M indicate a driving cycle, i. e. positive work, and the letters N indicate a compression cycle, i. e. negative work. The letters M and N are indexed with the corresponding piston numbers.

In examining these diagrams, it will be seen that when the pistons are moving towards the left, the cylinder 15, which is being charged at

high pressure, develops a force OG acting towards the left on the piston 12a and producing positive work shown by a shaded rectangle. Simultaneously the cylinder 17, which is being discharged at high pressure develops a force OH acting towards the left on the piston 12b and producing negative work shown by a rectangular shaded surface.

The active surface of the piston 12a being smaller than the one of piston 12b these two forces and their respective work are not canceling each other; their algebraic sum is represented by OK on Figure 6. The small negative work done by this force equal to the arithmetic difference of the amounts of work corresponding to the transfusion work (large rectangle in Figures 1 and 2) is represented by the small shaded rectangle in Figure 6. Thus, it will be seen that the force transmitted to the driving pistons during their motion towards the left is far from being the sum of the forces acting on the pistons during the transfusion, and is equal to their difference; the correlative losses in the mechanism will therefore be proportional to this difference and not to this sum.

As it was stated that the difference of the cross-sections in the present case amounts to some 7 to 15%, it will be seen that this arrangement reduces the stresses corresponding to the transfusion, which represent the major part of the work brought into play, by some 95% as compared with a machine of known type. Without pretending that the losses would actually be reduced to such an amount, it may be assumed that the reduction will be up to about 90%, which is already a satisfactory achievement, this work representing as stated the major part of the total work brought into play (generally almost ¾ of the total work).

In the example shown, it has been assumed that during the motion towards the left of the pistons shown in Figure 5, the low pressure exists on both sides of the pistons 11 and 13 and that, therefore, the resulting force exerted on them by the fluid is nil, what explains that the point on the diagrams Figures 5a and 5b corresponding to the position of these pistons is on the axis of abscissae. When the train of pistons according to Figure 5 returns towards the right, the gas contained in both cylinders 17 and 18, which are in communication, is being compressed while exerting on the piston 13 a force directed towards the left and which is gradually increasing as per curve KL, i. e. absorbing the work KLO. During the same piston stroke, the gas exerts on the piston 12b a force directed towards the right and which is gradually increasing as per curve OP, i. e. developing a positive work OPQ. During the motion of the pistons towards the right the gas contained in the cylinders 14 and 15, which are then in communication as already seen, expands while exerting on the piston 11 a force directed towards the right and which is gradually decreasing as per curve RS, i. e. producing a positive work ORS. In expanding, the gas contained in the cylinder 15 exerts on the piston 12a a force directed towards the left and which is gradually decreasing as per curve TO, i. e. producing negative work TOU.

In Figure 6, the curves KL and OP are shown opposite each other and the dotted line V indicates the algebraic sum of their ordinates, i. e. the algebraic sum of the forces acting on the pistons 12b and 13 during the stroke towards the right. In Figure 6, the curves RS and TO have also been shown opposite each other, as well as the algebraic sum of their ordinates represented by the dotted curve W. Therefore, this curve W represents algebraic sum of the forces exerted by the gas on the pistons 11 and 12a during the movement of these pistons towards the right.

Finally the curve representing the algebraic sum of the ordinates of the curves V and W is shown by X in Figure 6, i. e. the resultant of the forces exerted by the gas on the pistons 11, 12a, 12b and 13 during the stroke of these pistons towards the right. It will be seen that this resultant force performs a small positive work, which is represented by a shaded curvilinear triangle above the axis of abscissae, and a small negative work represented by a shaded curvilinear triangle below the axis of abscissae. In this case there is no compensation, but it will be seen on the diagram that the sum of the absolute values of such work represented by the shaded triangles (to which the losses are proportional) is small as compared with any one of the shaded surfaces shown in Figures 5a and 5b, so that a very important reduction of the losses is obtained during the stroke towards the right.

The functioning of the parts shown on the right hand side of the Figure 7 will now be easily understood; it is similar to that of the parts on the left hand side, apart a question of symmetry.

Although the apparatus will work with one side in action only, a better balance (from the point of view of forces) will be obtained if it is double-sided, such as schematically shown in Figure 7.

If it is desired to balance the inertia, two groups of pumps may be arranged in tandem and provided with inverse movements, or side by side, near enough, so as the moments developed will be small.

Still in a more simple way the two halves of the mechanism shown in Figure 7 may be actuated in opposite directions by driving them separately by two crank-arms set at 180°; the two possible solutions are then:

(*a*) each of the two groups are arranged as in Figure 7, only the simultaneity of the phases is changed as it will easily be understood. The four transfusions then take place simultaneously with the production of a small total moment, but the two phases compression-expansion are also simultaneous with superposition of their negative and positive work, which increases the maximum efforts acting on the machine;

(*b*) one of the two groups is inverted; in this case a proper equilibrium of forces due to pressures as well as due to inertia is obtained.

It would also be possible in an alternative to provide that the two pistons 12a and 12b, instead of being integral, are connected both to a crank pin, each through a connecting rod. In this case, the apparatus could possess two compression and two driving pistons only.

If it is desirable to alter the compression ratio, it is possible to simultaneously alter in the inverse directions the dead compression and expansion spaces by shifting longitudinally each of the cylinder groups in the direction required in order to produce the same respective variations in each group; this may be accomplished, for example, by means of a screw, rack or link mechanism, preferably irreversible. As the pressure ratio would then be different from the one for which the apparatus has been designed, it would be necessary to use under- and overpressure safety valves, of the type described in Swiss Patent No. 61409, and this at least for the driving

cylinders. Such valves should be fitted to the compression cylinders if they possess mechanically-operated valves. On the driving cylinders, it is advantageous to locate such safety valves on the partition 16 and on the piston 11, these valves being identical with the automatic valves being in the homologous position on the compression side. For example, the fingered valve described in the Swiss Patent No. 61,409 may be used.

The part 32, which has been indicated to be a valve, may be replaced by an automatic annular flap-valve fitted to the partition 19; the same refers to 33. The flap-valves thus substituted may be of any type, the one in partition 19 may, for example, be of the fingered shape as described in the patent mentioned above, the flap-valve 34 being, for example, constituted by a narrow and long swinging blade covering a slot extended at right angles to the plane of Figure 3.

In order to economize power, the mechanically-operated valves will be preferably of the type described in Swiss Patent No. 61409 driven by a cam mechanism having two races with double rollers and a recovery of kinetic energy.

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PUBLISHED JULY 13, 1943. BY A. P. C.

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PROCESSES FOR THE PRODUCTION OF HEAT OR COLD BY MEANS OF A THERMAL PUMP WITH PISTONS AND TO THERMAL PUMPS FOR THE WORKING OF THESE PROCESSES

Filed Feb. 13, 1942

Serial No. 430,814

2 Sheets-Sheet 1

Fig.1.

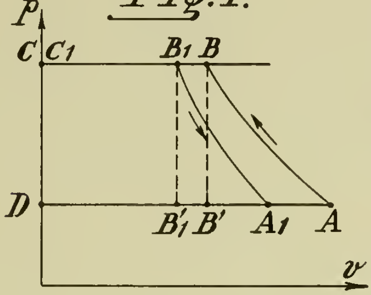


Fig.2.

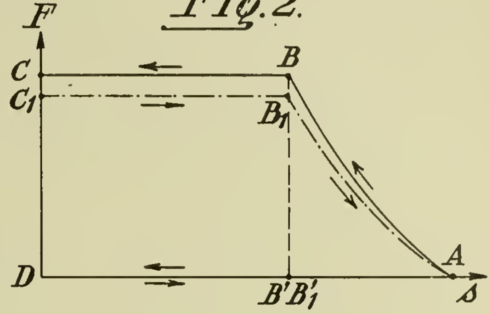


Fig.3.

Fig.3a.

Fig.3b.

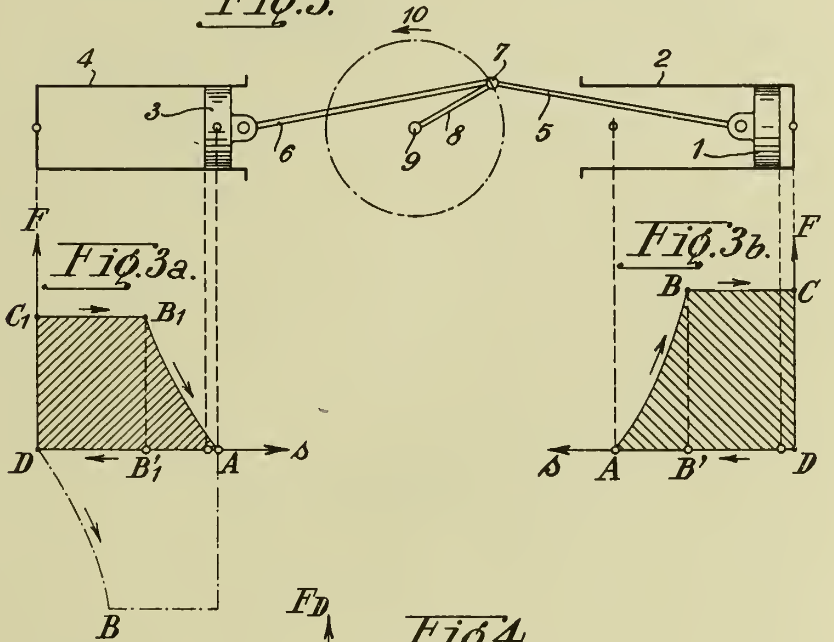
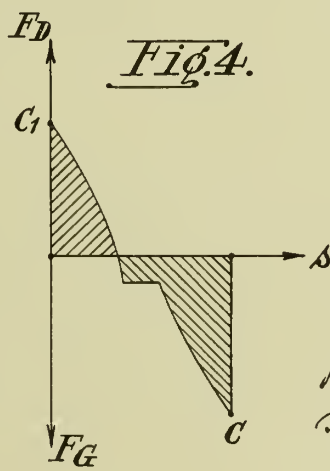


Fig.4.



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2 Sheets-Sheet 2

Fig. 5.

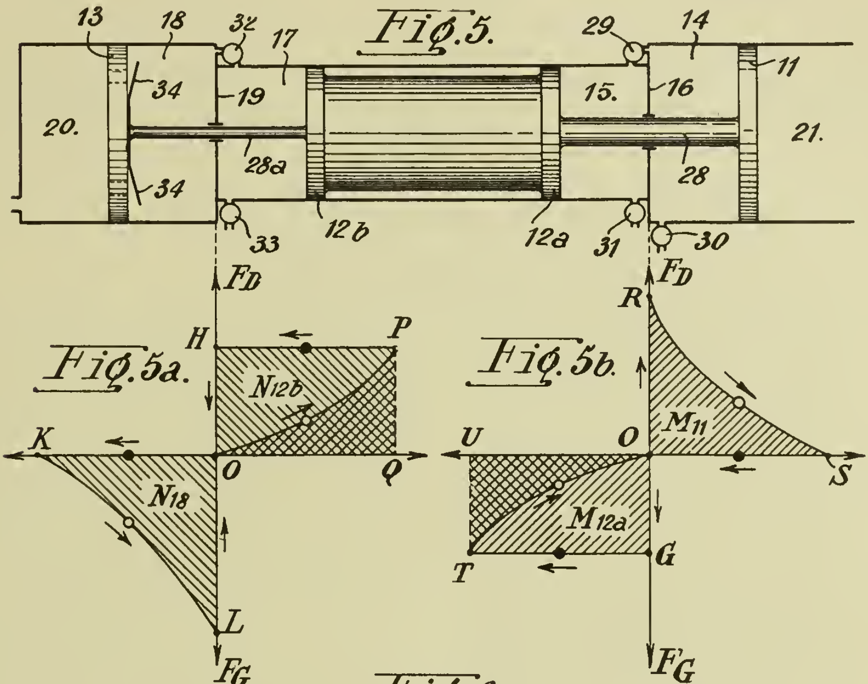


Fig. 5a.

Fig. 5b.

Fig. 6.

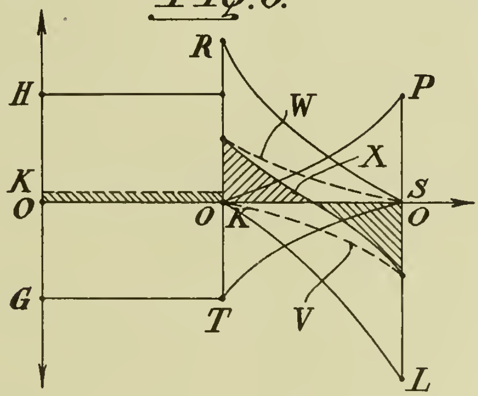
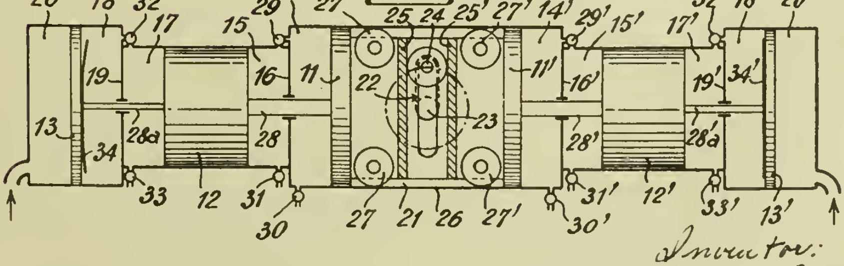


Fig. 7.



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ALIEN PROPERTY CUSTODIAN

GEAR PUMPS

Geza Walter Müller, Bron, France; vested in the Alien Property Custodian

Application filed March 7, 1942

The present invention relates to gear pumps and more particularly to such gear pumps as are used industrially for displacing viscous fluids, for example fluids of this category employed for spinning artificial textile filaments and threads, and as are generally interposed between a master pressure pump and the spinning dies, the chief function of such gear pumps being to regulate the rate of delivery of the fluid.

An object of the invention is to provide for the aforesaid and like uses a gear pump having such an improved construction as to fulfil practical requirements under better conditions than similar pumps as used heretofore.

Another object of the invention is to provide an improved gear pump the structure of which is so devised as to cause the whole of the fluid flowing therethrough to perform during operation lubrication of at least some of the revoluble members of the pump and particularly of the gear shafts.

Another object of the invention is to provide a gear pump having such an improved structure as to damp away the fluid pulsations, thereby enhancing the steadiness in the rate of flow of the liquid and ensuring better spinning conditions when said liquid is used for the production of artificial textile filaments or threads.

A further object of the invention is to provide a gear pump of such improved construction as to enable the fluid to circulate therethrough directly without being hindered or throttled and without any whirling or stopping effect, thereby avoiding such sedimentations as might otherwise clog up the circuit or interfere with proper spinning conditions.

A still further object of the invention is to provide an improved gear pump of simple and rugged construction particularly well suited for the handling of viscous liquids used in the production of artificial textile filaments and threads and comprising self-contained means ensuring automatic flushing lubrication by the liquid itself and at the same time great regularity of flow.

With these and such other objects in view as will incidentally appear hereinafter, the invention comprises the novel construction, combination and arrangement of parts that will now be described with reference to the accompanying diagrammatic drawing exemplifying the same and forming a part of the present disclosure.

In the drawing:

Figure 1 is a vertical sectional view showing in its entirety an improved gear pump according to the invention comprising a body plate having recesses for the gears and side plates delineating and closing the pump body.

Figures 2 and 3 are elevational views showing the side plates.

Figure 4 is a side view showing the body plate separately.

Figure 5 is a diagrammatic elevational view showing the body plate, the other parts being omitted.

Figure 6 is a sectional view along the line X—X of Fig. 5.

Figure 7 is a sectional view of a modification of a detail of the pump.

Like reference characters designate like parts throughout the several views.

The constructional form of the invention illustrated in the drawing is a gear pump specially adapted for the handling of viscous liquids adapted to be spun into filaments or threads such for example as viscose, acetate, cupro-textile, artificial wool or the like.

Advantageously the pump body comprises a middle or body plate **1** formed with a pair of circular recesses **2** in which the gears **3** are snugly received. The middle plate **1** is closed and delineated sidewise by a pair of side plates **4**, **5** through which are revolubly engaged the pins **6**, **6_1** carrying the respective gears **3**.

The side plates **4**, **5** are hollowed to provide the suction duct **8** and the delivery duct **9** of the pump. The ducts **8**, **9** preferably have their axes at right angles to the gear-carrying pins and have openings *a*, *b*, *c*, *d* which communicate with the holes in the side plates **4**, **5** through which the pins **6**, **6_1** are journalled.

Communication between the suction duct **8** and the suction chamber **18** of the pump takes place through a duct **10**, a chamber **11** and a further duct **12**. Likewise, communication between the delivery chamber **19** of the pump and the delivery duct **9** takes place through ducts **13**, **14** and **15**.

The chamber **11** is preferably formed in a separate front bracket **17**, while the duct **14** is formed in a rear plate **16**, said bracket and plate being bolted or otherwise fixedly secured to the side plates **4**, **5** and pump middle plate **1**.

As shown in Figs. 1 and 2, there is advantageously interposed on the delivery duct **9** intermediate the holes for the pins **6**, **6_1** a ring or washer **20** having an annular groove **21** communicating with said duct **9**. The ring or washer **20** may be axially bored to provide the duct **13** which communicates with the delivery chamber **19** of the pump and also with the duct **14**.

The path of the liquid through the apparatus

shown in the drawing is as shown by the arrows and may be described as follows:

The liquid sucked in by the pump enters the apparatus through the inlet aperture **22** and flows through the duct **8**, then successively contacts or "licks" the front ends of the pins **6**, **6_1** where they are journalled in the side plate **4**. Thereafter the liquid enters the annular chamber **11** through the duct **10** and penetrates into the suction chamber **18** of the pump through the duct **12**. The liquid forced out of the delivery chamber **19** enters the duct **14** through the duct **13** bored in the ring **20** and then penetrates into the duct **9** through the duct **15**. After contacting and flushing the part of the pin **6_1** journalled in the side plate **5** and flowing through the groove **21** in the ring **20** (see Fig. 2) the liquid contacts or "licks" the part of the pin **6** journalled in the side plate **5** and is discharged through the outlet aperture **23**.

It will be seen that the whole of the liquid moved by the pump can thus contact or flush both ends of the gear-carrying pins **6**, **6_1** where they are journalled in the side plates **4**, **5**.

The circulatory circuit which has just been described presents amongst others the advantage of providing a through passage devoid of any throttling point and of giving rise to no whirling or stopping point where otherwise the liquid might settle down and build sediments which might choke proper flow and hinder suitable spinning operation.

Alternatively, the following constructional arrangements may be adopted:

The gears **3** may be so mounted or splined upon their operating pins **6**, **6_1** as to "float" upon them, the driving feathers **25** housed in said pins coacting with grooves **26** formed in the bore of said gears **3** so that no axial thrust can be transmitted to these gears.

In order to provide for the required degree of liquid tightness on that side where the pin **6_1** is driven by the outer control shaft **27**, elastic gasket **28** is provided so as to seal the chamber **11** on the front side. As shown in Fig. 1, said gasket comprises a U-shaped annulus and may be made for example of synthetic rubber.

Furthermore, owing to the fact that it contacts with the pumped fluid, said elastic gasket has the supplementary effect to damping the pulsations and to avoiding the irregularities of the rate of delivery of the pump.

In the constructional form shown, the gasket **28** is abutted against a washer **29** having a tight fit in a shouldered portion of the front bracket **17**.

In order to improve said damping effect of the gasket **28**, it is advantageous to provide the latter with grooves in one at least of the contact walls between said gasket and the washer **29**. Preferably, these grooves having a suitable shape, for example a circular (grooves **28_1**, Fig. 7) or radial shape, will be situated in the bottom wall of said gasket **28**.

The shaft **27** which may be connected to the pin **6_1** in any approved way drives the latter advantageously as illustrated in Fig. 1 owing to co-action between grooves **30** in the rear end of said shaft and a key or cotter **31** set through the pin **6_1**. The sectional area of the key or cotter **31** is preferably reckoned so that in case of jamming or of any abnormal resistance occurring in the pump operation, said key or cotter **31** should be sheared, thereby protecting the rest of the mechanism against any such undue stress as might otherwise seriously damage the most costly parts of the apparatus.

In accordance with another alternative feature of the invention, the shaft **27** is independently lubricated, for example by means of a lubricator **32** having a screw-threaded reduced shank engaged through a hole tapped in the bracket **17**, the extremity of said shank being in communication with a groove **33** in said shaft so as to hold the latter in proper longitudinal position.

Moreover, according to a particularly advantageous arrangement, the suction chamber **18** and delivery chamber **19** formed in the middle plate **1** are defined by walls extending askew and generated by the intersection of an oblique cylinder (as shown in chain lines in Fig. 6) or a skew prism with the cylindrical recesses **2** in which the gears **3** are accommodated, the geometrical axis Y—Y of said cylinder or prism being situated in the plane of tangence X—X of the pitch circles *e* of the gears **3** and passing through the point of contact O of the pitch circles located in the mean plane of said gears. The degree of slant of those edges which define the suction chamber **18** and the delivery chamber **19** with respect to the gear teeth should be preferably so selected as to cause the nicks of two consecutive teeth to be continuously in communication with said chambers **18**, **19**. The purpose of this arrangement is to regularize the rate of delivery of the pump.

According to a further alternative constructional form, regularity of the rate of delivery may be still further improved (this being of the utmost importance for spinning) by interposing either on the suction duct or preferably on the delivery duct of the pump a second resilient damping member such as a rubber pad or stopper **34** arranged in the end of the duct **9** and providing for the resilient material of which it is made an accurately bored recess **35**. Said stopper **34** is fitted on a cap plate **36** fixed to the side plate **5** by means of a screw **37**.

It will be seen that owing to the foregoing construction, the several objects of the invention are fulfilled inasmuch as it becomes possible by simple and cheap manufacturing means to provide a self-lubricating gear pump using the pumped liquid as a lubricating medium and possessing great regularity of rate of liquid delivery, thereby ensuring a major advantage particularly where the pump is intended to feed liquid to spinning dies in the production of artificial textile materials.

GEZA WALTER MÜLLER.

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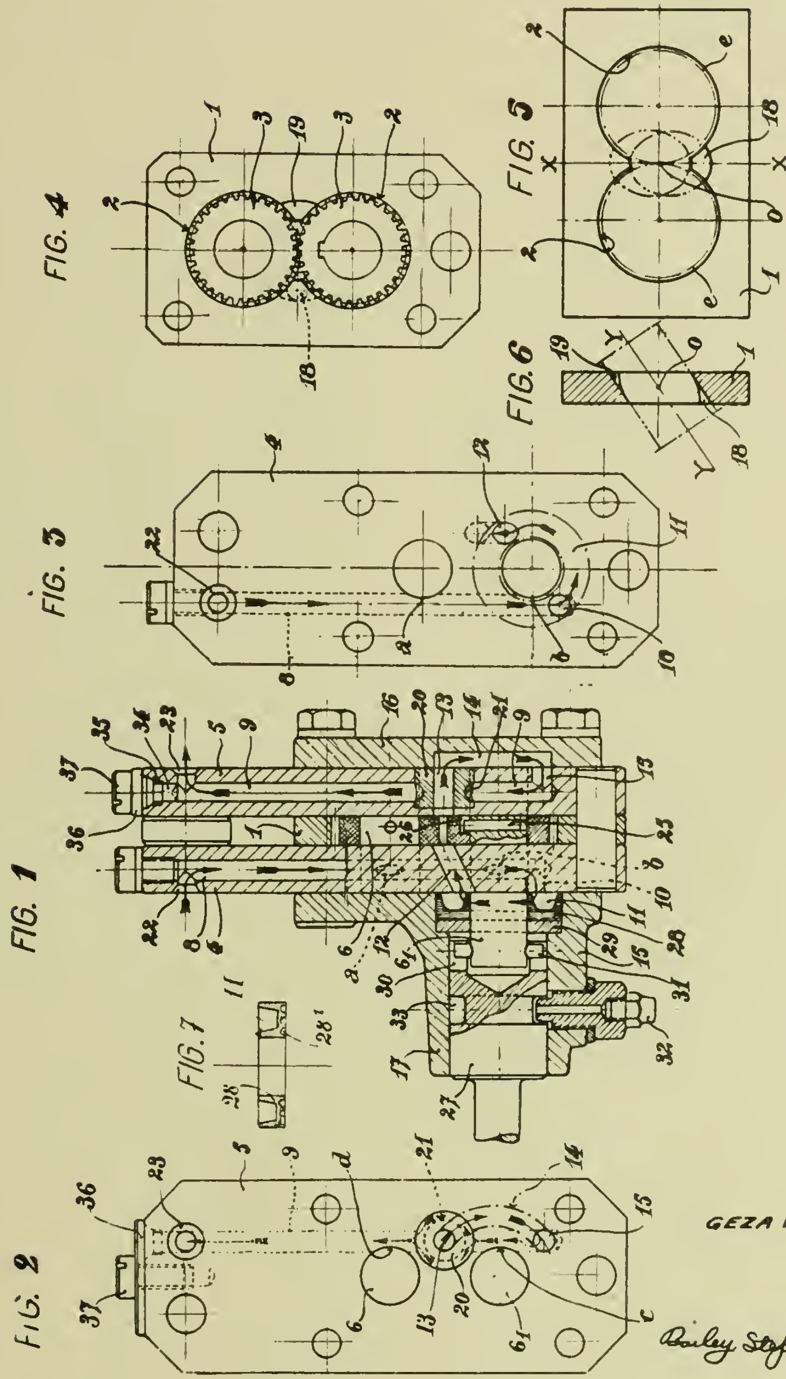

Inventor

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Published June 1, 1943 Serial No. 435,234

ALIEN PROPERTY CUSTODIAN

METHOD AND MACHINE FOR CONSTRICTING A TUBE BY MEANS OF A REVOLVING DIE

Oreste Flavio Alfred Biginelli, Clermont-Ferrand, France; vested in the Alien Property Custodian

Application filed March 18, 1942

This invention relates to a method and a machine for constricting a tube by means of a revolving die.

With the hitherto known methods from a certain diameter the constriction of tubes in a hollow state, i. e. without the use of an inner mandrel is a difficult operation which practically can be effected only by means of machines acting through hammering on the tube revolving about its axis. This work is effected on annealed metal and for somewhat important constrictions it requires a plurality of operations with an equal number of intermediary annealings. This process is a noisy and comparatively slow one.

This invention has for its object to avoid these drawbacks and to permit of effecting the constriction irrespectively of its magnitude in a smooth operation and of insuring a quick working, since the duration of the advance of the die is of a few seconds only, and it being possible to apply the said process on both ends of the tube successively.

According to this invention the method which permits of attaining the above mentioned aims shows the characteristic features which result from the following description and from the appended claims.

In the drawing the device which is necessary for effecting the processes of the operation of constriction is shown by way of example.

Figures 1, 2 and 3 show the various steps of the operation.

Figures 4, 5, 6, 7, 8 and 9 show different forms of constriction and the dies used for making the same.

Figure 10 shows the machine for carrying into practice the processes according to the invention.

The device is essentially formed of a press frame which comprises, on the one hand, a device for obtaining a double acting press movement in the longitudinal axis and, on the other hand, a plate revolving about the said axis.

1 is an extension of the press slide which can slide in the longitudinal direction but the rotation of which about the axis is prevented owing to the fact that it is guided on the standards which are fast with the frame.

The extension **1** of the frame receives a clamping chuck which permits of firmly securing the end of the tube opposed to the end to be constricted. In the example of Figure 1 this clamping chuck is formed of the following three parts:

1. An abutment encasing the tube;
2. A clamping member **3** of outwardly conical and inwardly cylindrical shape which is adjusted outwardly of the tube; this clamping member is divided into sectors by planes passing through the axis.
3. A clamping chuck **4** which is screwed on **1** and has inwardly a conical shape corresponding to the external shape of the sectors **3**. By screwing this casing on **1** the sectors **3** are clamped on the tube which has been previously encased on the abutment **2**, thus rendering the said tube fast and compelled to follow the longitudinal press movement.

5 is the plate revolving about the axis and counterabutted on the frame in both directions so that it can move in the longitudinal direction.

The constriction tool equipment comprises:

1. A revolving die **6** encased on the plate **5** which imparts its movement of rotation to the die by means of the key member **7**, and
2. A fixed die **8** fast with the press frame.

The processus of the constricting operation is as follows:

The press slide being in the position shown in Figure 1, the tube **9** is set on the clamping chuck.

The die **6** is revolved and the press movement is started towards the left.

The end of the tube first engages the fixed die **8** which obliges the tube to center itself exactly on the axis and imparts to it a first constriction which is still comparatively small. Thus the tube takes the form **10** shown in Figure 2.

Through its clamping action on the tube this die also partially prevents the rotation of the tube and thus diminishes the torsion stress imparted to the body of the tube by the action of the revolving die.

The movement of the press then going on towards the left, the wall of the end of the tube engages the revolving die **6**. Since the tube cannot revolve owing to the fact that it is clamped on the abutment **2** of the press slide and in the fixed die, a considerable rubbing action results therefrom between the wall of the end of the tube and the revolving die, thus producing a heating action which renders the metal of this wall sufficiently malleable for causing the movement of the press to oblige the tube to take the form of the revolving die.

On the end of the operation the tube has taken the form **11** shown in Figure 3.

As soon as the constricting operation is achieved the press slide is returned back, i. e. to the right so that it resumes the position of Figure 1. During this movement the constricted end is drawn out of both dies **6** and **8** and the

tube can be released by loosening the clamping chuck 4.

As above explained, the form of both dies, the fixed die 8 and the revolving die 6 must be adapted to the constricted form to be obtained.

By way of example Figure 4 shows at 12 and 13 respectively the form of the fixed and of the revolving dies which permit of obtaining the constricted form with a neck shown in Figure 5.

Figure 6 shows this form at 14 and 15 for obtaining the constriction shown in Figure 7 and Figure 8 shows at 16 and 17 the said form for obtaining the constriction with upsetting of the metal inwardly as shown in Figure 9.

The method according to the invention which permits of effecting a constriction in the hollow state can be applied successively at both ends of the tube, thus permitting to obtain from a tube the form of a bottle or vessel with two necks, which is not possible with the methods requiring for the constriction the use of an inner mandrel of a given form. The only modification of the above described device for obtaining the second constriction consists in adapting the clamping shuck 4 of the press slide so that the latter can receive and firmly secure the tube end which has received the first constriction.

Figure 10 shows by way of example a form of execution of a machine for carrying into practice the process according to the invention.

On the frame 10 of the machine is mounted, on the one side, a double acting hydraulic press cylinder 19; 20 and 21 are the inlets for the fluid coming from the pump. The end of the piston rod is guided by a slide 22 and carries the clamping chuck 3.

On the other side the frame carries the device for rotating the revolving die. This device comprises an electric motor 24 which drives the revolving plate 5 by means of a speed controller 26.

The plate 5 is mounted on ball bearings and abutments so that it can rotate without being shifted in the longitudinal direction under the action of the press. It carries the revolving die 6 which is encased and keyed on the press face; the speed controller permits of importing to the revolving die a speed of rotation which is adapted to the diameter, the thickness and the kind of the metal of the tube to be treated.

Against the external face of the revolving die 6 is arranged with a small play the fixed die 8, which is fast with the frame of the machine.

ORESTE FLAVIO ALFRED BIGINELLI.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

O. F. A. BIGINELLI

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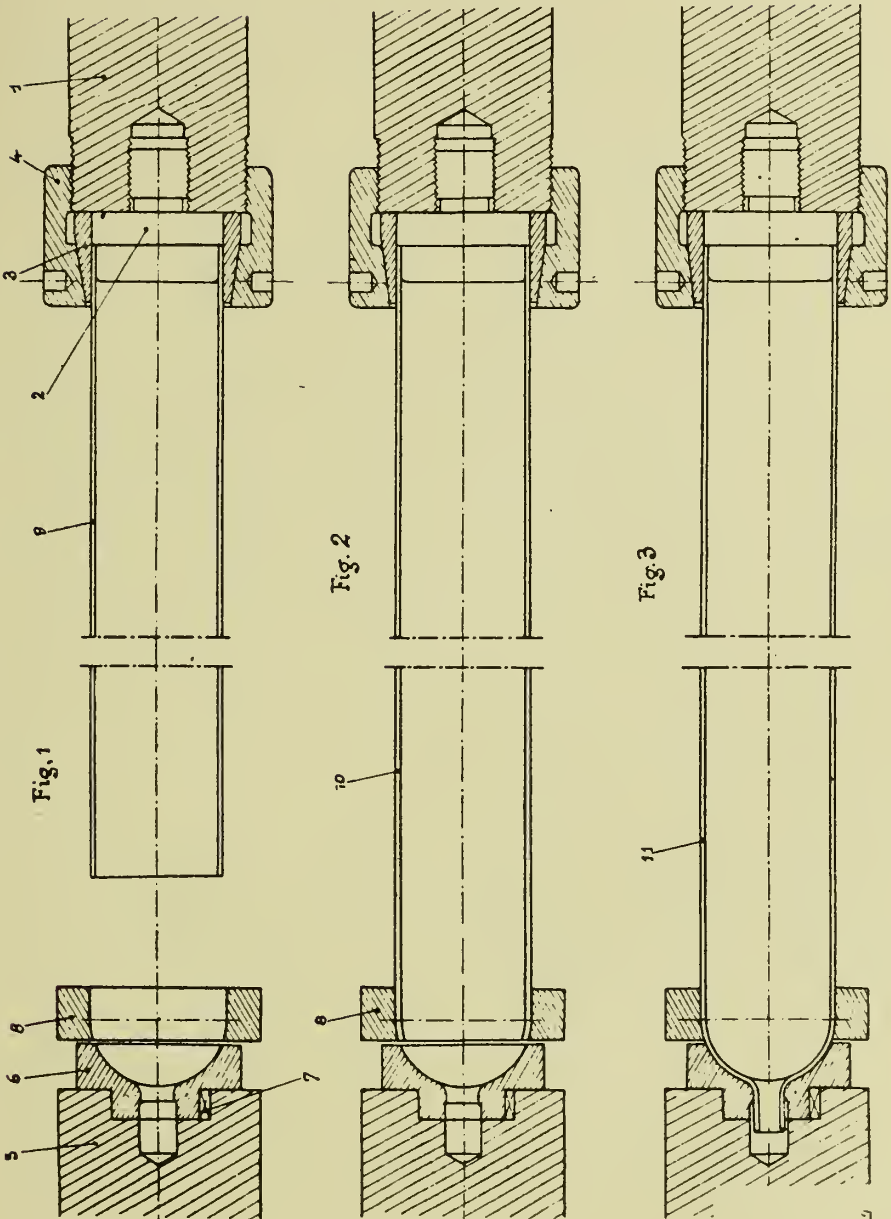
3 Sheets-Sheet 1



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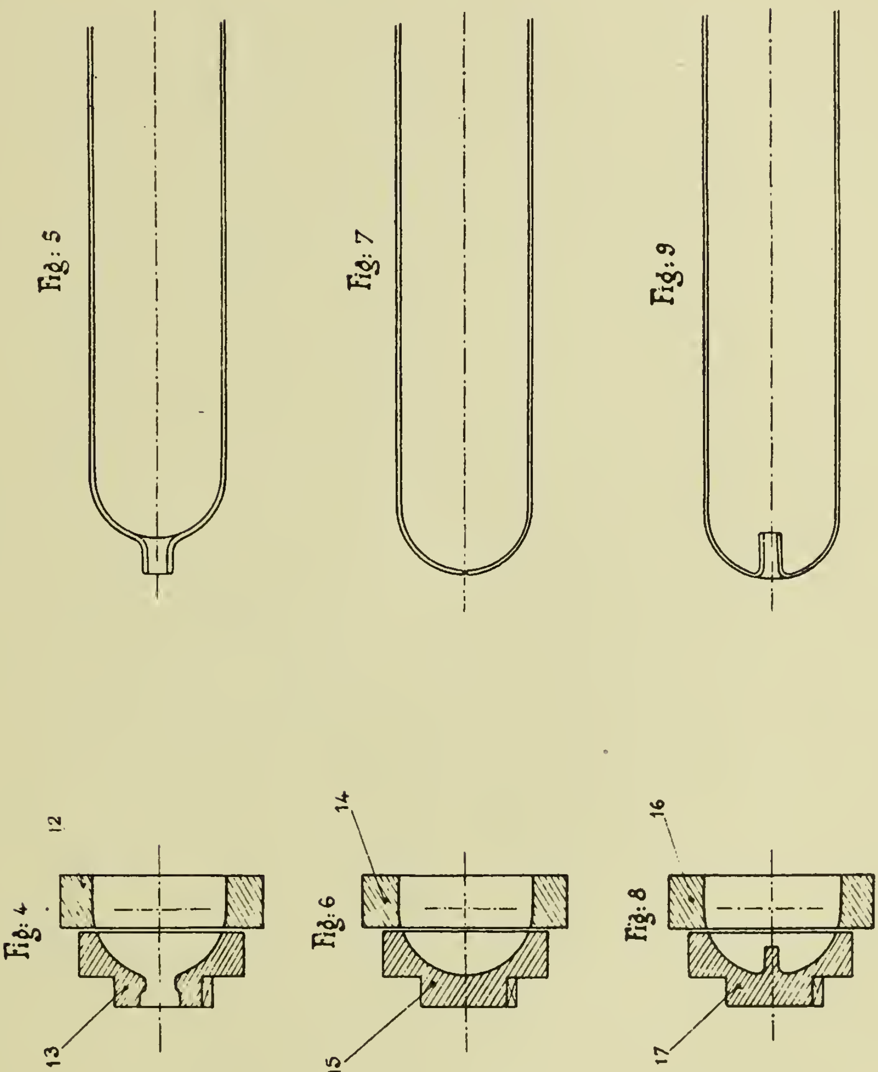
3 Sheets-Sheet 2



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3 Sheets-Sheet 3

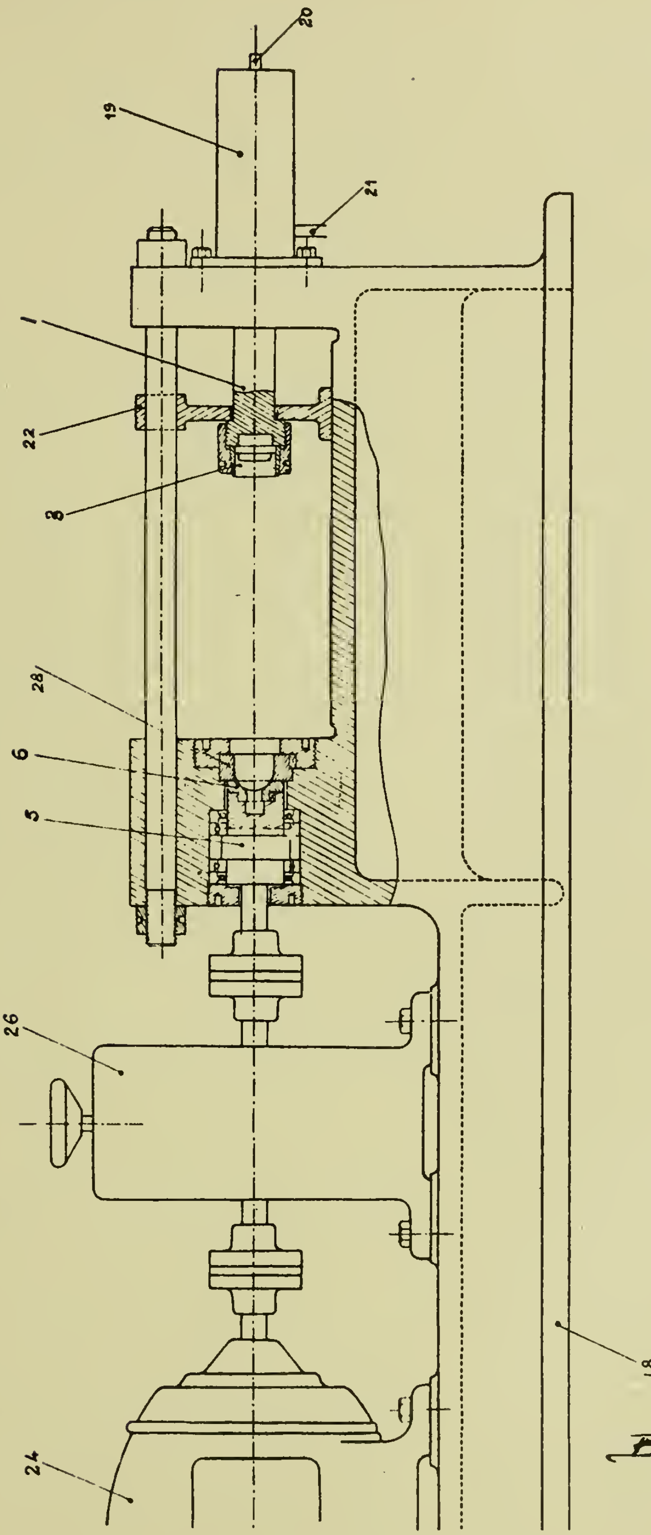

Fig: 10

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ALIEN PROPERTY CUSTODIAN

ELECTRIC CLOCK MECHANISM

Arthur Quebatte, Boulogne - sur - Seine, and Edouard Seignol, Paris, France; vested in the Alien Property Custodian

Application filed April 2, 1942

This invention relates to time pieces and particularly to improvements in the electric clock described and claimed in the application of Arthur Quebatte and Edouard Seignol, Serial No. 199,036, filed March 30, 1938.

An important object of this invention is to provide improvements in electrically operated clocks which increase their accuracy of operation, simplify their construction, and reduce the electric current consumption. Another object of this invention is to improve the ruggedness of the clock structure so that it will withstand considerable abuse without impairing its function. All these objects are accomplished by associating certain elements of the clock mechanism together in a distinctly novel manner and by providing novel features on these elements which cooperate with one another to drive the clock mechanism accurately over long periods of time.

The description of the invention which follows and the accompanying drawings show by way of example a structural embodiment of the present invention. It is evident that the details of construction shown in the drawing and described herebelow are able to be combined or employed separately as desired and modified to suit different conditions.

Various other objects, advantages and meritorious features of the invention will become more fully apparent from the following specification, appended claims and accompanying drawings, wherein:

Fig. 1 is a back view of a clock embodying my invention.

Fig. 2 is a sectional view through a portion of the mechanism of the clock showing in enlarged detail the invention and associated operating parts,

Fig. 3 is a back side view of my novel form of double pallet fork and associated parts, and

Fig. 4 is a front side view of my double pallet fork.

Referring in detail to the drawings, the electromagnet coil 10 produces when energized a magnetic field in a stationary armature 12 having opposite pole sections 14 and 16. A balance wheel 18 is fixed on a shaft 20 and is shaped with three arms as shown, two of which are capable at the same time of approaching into close magnetic relationship with the pole sections 14 and 16. The balance wheel 18 is formed of two metal pieces and functions as a movable armature between the poles of the fixed magnet and as will become more apparent hereinafter its oscillations are magnetically influenced thereby.

The operating mechanism is mounted between a front supporting plate 22 of circular dimension and a rear supporting plate 24 of irregular formation. These plates are secured together in spaced parallel relation by pillar posts 26. Three are shown in Fig. 1 and each is insulated from direct contact with the plate 24 as indicated by insulating washers 28. The pole sections of the fixed armature are secured to the pillars in a plane slightly forward of the back supporting plate. In advance of the fixed armature is a third or intermediary supporting plate 30 (Fig. 2) of irregular formation. The majority of the shafts of the clock mechanism have their ends journaled in this third or intermediary supporting plate and the front plate 22. The balance wheel shaft 20, however, is of longer length and is journaled between the front and rear supporting plate 22 and 24 as shown in Fig. 2.

Leads 32 and 34 deliver direct electric current from any suitable source of electricity, such as a wet or dry cell battery of proper voltage. The lead 32 is connected directly to the coil 10 through a conductor 36 insulatively supported on the back plate 24 and through a wire 38 from the conductor to the coil. The opposite end of the coil is electrically connected to the rear plate 24 by wire 33. Lead 34 is connected to the front platee at 35. From there the circuit is completed back to the coil 10 through a novel electric make and break device associated with the balance wheel which is hereinafter described and also described and claimed in the aforesaid application for patent of Arthur Quebatte and Edouard Seignol.

The balance wheel 18 as previously described oscillates back and forth with shaft 20 between the opposite poles of the magnet. As customary, a spirally coiled spring, shown in cross section at 40 in Fig. 2 is provided to yieldingly oppose the oscillations of the balance wheel and to return it after each oscillation. It is fixed at one end to the shaft 20 and at the other end to any immovable part of the clock such as the back plate 24. Journaled to the back plate 24 for rotation about the axis of the balance wheel is a speed regulator 42 having a pair of depending elements 44—44′ which extend past the opposite sides of one of the loops of the spiral spring. Adjustment of the regulator to various positions will vary the resistance of the spiral spring to the oscillations of the balance wheel and thereby alter the rate of advance of the clock mechanism.

The clock face or dial is indicated at 40 and extends in spaced parallel relation to the front supporting plate 22. The minute and hour hands

are indicated at 46 and 48 respectively. The minute hand is fixed to shaft 50 projecting through the center of the dial and journaled in the supporting plates 22 and 30. The hour hand is fixed on a sleeve 52 carrying a gear wheel 54.

Disposed in line with shaft 20 but spaced therefrom and from each other are two shafts 56 and 58. Shaft 58 carries an escapement wheel 60 and a worm gear 62. Shaft 56 carries novel means including fork-like instrumentalities which extend on the one hand to the balance wheel shaft to receive driving impulses therefrom and on the other hand to the escapement wheel to drive the same. The novel means is a composite structure formed of elements associated together on shaft 56 and partaking of the same movement. Because of this compact association and joint action, the assembly of these elements is referred to as a body.

The body on shaft 56 comprises a metal sheet or plate 64 shaped with narrow arms 66 and 66' (Fig. 3) which extend to and partially embrace the escapement wheel 60. The extremities of the arms are each correspondingly shaped to provide an operating finger 68 and a retaining finger 70. As will be described more particularly hereinafter, the body on shaft 56 receives driving impulses which cause it to rock back and forth. As a result the arms 66 and 66' alternately swing into and out of engagement with the escapement wheel which is of star shape design. As the body rocks back and forth, the operating finger of each arm is adapted to engage a tooth in the escapement wheel and cause the wheel to rotate a part of its revolution. The retaining finger 70 of the particular arm engaging the escapement wheel then functions to stop the advance of the next succeeding tooth on the escapement wheel. Thus as the arms swing back and forth the escapement wheel is intermittently rotated in one direction around its axis of shaft 58. The escapement wheel is of novel design as shown. The teeth are few in number, three in this particular instance, and are quite widely spaced apart. The arms 66 and 66' are each shaped in a novel manner to provide both an operating finger and a retainer finger on the end thereof. The engaging portions of the escapement wheel and the arms 66 and 66' are formed integrally on their respective members and result in a saving in material and space.

On the same body as plate 64 but spaced therefrom is a second metal plate or sheet 72 shaped with arms 74 and 74' which extend toward and partially straddle the shaft 20. Carried on member 76 fixed to shaft 20 is a pin 78. This pin extends parallel to but spaced from the axis of shaft 20 and as the balance wheel oscillates it traverses an arcuate path back and forth in timed relation thereto. This pin projects between the arms 74 and 74' and in its swinging movement strikes these arms and causes the plate 72 and associated parts to rock back and forth about the axis of shaft 56.

On the side of plate 72, opposite to plate 64, is a thin sheet 80 of flexible metal material. This sheet bears on a circular shoulder 82 formed on shaft 56. This shoulder forms a seat for the whole body holding the same against axial movement toward the front of the clock. Sheet 80 is cut or otherwise shaped to provide a pair of flexible strips or fingers 82 and 82' which extend substantially parallel to one another and perpendicular to one another. To reduce the cost of manufacture and conserve space it is preferred that the strips 82 and 82' be formed integrally out of sheet 80. As shown in Figs. 2 and 4, the sheet is bent at 84 on the side adjacent to the escapement wheel axis. From this bent section the two strips 82 and 82' extend. They are bent with respect to section 84 so as to overlie the sheet 80 and extend parallel to one another past the opposite sides of the shaft 56. The free ends of these strips overlap upon the path of swinging movement of the pin 78. The free ends of these strips lie closer together than the arms 74 and 74' and are so disposed with respect thereto that the pin in its swinging strikes the ends of the flexible strips before striking the arms. A portion of plate 86 near the balance wheel shaft is turned down as shown in Fig. 2 to serve as a stop limiting the distance the two strips may move toward one another.

Insulation material in the form of a sheet or block 88 is interposed between the plates 64 and 72, and functions not only as a spacer but also electrically insulates one sheet from the other. The separate components of the body on shaft 56, elements 64, 72, 80 and 88, are loosely assembled on the shaft but partake of joint rocking movement because of the provision of novel means keying the elements to the shaft. This is accomplished by widening that part of the shaft 56 above the circular shoulder 82 in one dimension like that shown at 90 in Fig. 3. The composite body structure on the shaft is correspondingly apertured so that it will slidingly fit upon the widened section of the shaft. The latter will therefore function as a key holding the parts together for joint rocking movement. It is obvious that the parts of the composite device on shaft 56 are assembled thereon from the end journaled on the intermediary supporting plate 30.

The balance wheel shaft 20 is provided with a widened portion 92 of general circular character. It is, however, flattened on the side adjacent to shaft 56. Carried by plate 64 on the part nearest shaft 20 is a pointer-like element 94 which projects toward the shaft 20 and close enough to be struck by the flattened side of the widened section 92 of the shaft when the latter oscillates about its axis. However, the pin functions in advance of the flattened sides of portion 92.

The worm gear 62 on the escapement wheel shaft drives a large toothed wheel 96 on shaft 97. The latter shaft carries a worm 98 in engagement with a toothed wheel 99 mounted on shaft 50. The last mentioned wheel is frictionally coupled to the shaft 50. This form of mounting and the manner of regulating and starting the clock by the control knob 100 are described in the aforesaid application for patent of Arthur Quebatte and Edouard Seignol.

The operation of the device is generally apparent from the previous description. As previously described, one lead 34 from the source of electricity is connected to the front supporting plate 22. From thence the circuit may be traced through shaft 56 to the plate 80 and flexible strips 82 and 82'. When the pin engages either one of these strips, the circuit is closed through the shaft 20 to the rear supporting plate 24 where lead 33 completes the circuit to the electromagnet. This oscillation of the balance wheel may be started in any suitable way such as that described in the aforesaid application for patent. The pin 78, swinging in timed relation thereto, first strikes one of the flexible strips and then the adjacent arm 74 of the plate 72. The pin will engage the strip for a moment and then ride

off as it continues its swing. During the time it is in engagement with the strip, the circuit is closed to the electric magnet and the latter becoming energized exerts a magnetic force tending to draw the balance wheel even further than normally against the resistance of the spiral spring 40. After the pin swings out of engagement with the strip, the spiral spring takes hold and with added impetus oscillates the balance wheel back in the other direction. The pin returns without striking the strip it has just engaged and continues on until it strikes the other flexible strip. The same performance is then repeated except that both the pin and balance wheel are swinging in the opposite direction.

The alternate engagement of the pin with the flexible strips and arms 72 and 72′ causes the plate 70 and the shaft 56 to which it is keyed to rock back and forth. This movement is transmitted to plate 64 which through the arms 66 and 66′ causes the escapement wheel to rotate as previously described. Rotation of the escapement wheel is carried through a gear train including worm gear 62, wheel 96, worm gear 98 and wheel 99, to the shaft 50 to which the minute hand is fixed. By suitable reduction, gearing wheel 54 is caused to rotate and revolve the hour hand.

ARTHUR QUEBATTE.
EDOUARD SEIGNOL.

PUBLISHED

JULY 13, 1943.

BY A. P. C.

A. QUEBATTE ET AL

ELECTRIC CLOCK MECHANISM

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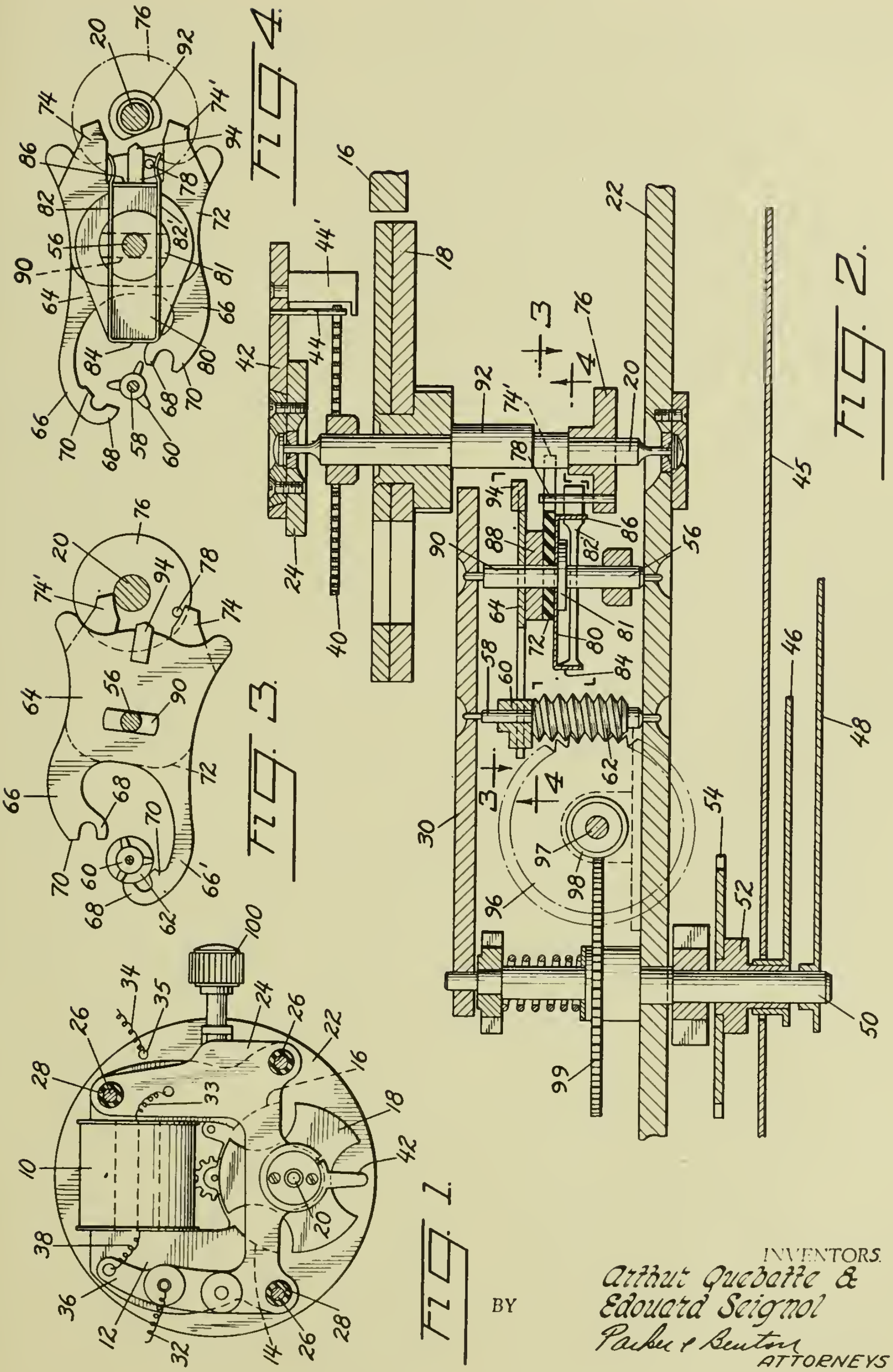

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ALIEN PROPERTY CUSTODIAN

VALVE CONTROL DEVICE

Raymond Lucien Rambert, Gonesse, France; vested in the Alien Property Custodian

Application filed April 8, 1942

It is known to perform the remote control of the opening or closing of a valve through generally intricated and expensive mechanical means.

The present invention enables to avoid the use of any mechanical means and consists in varying the section of passage of a conduit forming a balancing by-pass for the valve to be controlled and in using for performing the closure and the opening of the valve only the losses of pressure exerted by the passage of the fluid in the said conduit upon a moving set integral with the valve.

Preferably, the said conduit allows a reduced output of the fluid after the closure of the valve, the reduced output being itself stopped, if necessary, due to the closure of the conduit by the driving element.

By way of examples, the accompanying drawings show two embodiments of the present invention.

Fig. 1 is a top view of a valve control device according to the present invention.

Figure 2 is a section according the line II—II of Figure 1.

Figure 3 is a section according the line III—III of Figures 1 and 2.

Figures 4, 5 and 6 diagrammatically show the three positions of a valve which controls the feed of a liquid gauging and dispensing apparatus and of its control device according to the invention.

In the control device shown in Figures 1 to 3, **1** is the closing valve and **2** a dics integral with said valve **1**. The moving set is formed by the valve **1** and the disc **2** is slidable on a guiding rod **3** and is brought in the closing position of the valve **1** by a spring **4** bearing upon a piece **12** integral with the body **9** of the valve box. A shutter **5** controls the section of passage of a conduit **22**, **23**, connecting the chamber **7** located below the disc **2** with the chamber **6** located downstream of the valve **2**. The said shutter coacts with a removable seat **11**. The upper face of the disc **2** is directly subjected to the pressure prevailing in the chamber **8** located upstream of the valve **2**. The disc **2** does not slide tightly in its housing; a given amount of gap **10** is provided between the periphery of the said disc and the walls of the space within which it can be displaced, the said gap connecting the chambers **7** and **8** to each other and consequently both faces of the disc.

The operation of the device is as follows:

In the absence of any pressure within the upstream chamber **8**, the valve is pressed upon its seat by the spring **4**. When the pressure increases within the chamber **8** and if the shutter **5** is closed or if its leakage is quite reduced with respect to that due to the gap **10**, the conditions are balanced between both faces of the disc **2** and the valve **1** is kept closed, as well by the spring **4** as by the difference of pressure prevailing between the chambers **6** and **8**. When the shutter **5** is opened, the pressure within the chamber **7** will so much more tend to approach the value prevailing within the chamber **6** that the opening of the conduit **22**, **23** is wider. Consequently both faces of the disc **2** will be subjected to different pressures and the action resulting upon the said disc **2** will tend to open the valve **1**, but the latter will remain closed so long as the difference between the pressures prevailing within the chambers **6** and **8** is sufficiently reduced. A time will come at which the action of the disc **2** upon the moving set will be stronger than the action of the valve **1** and of the spring **4**. At that time, the valve **1** will open, thus connecting the chambers **6** and **8**. An increase of pressure will immediately result within the chamber **6**, thus tending to reduce once more the unbalance of pressure prevailing on both faces of the disc **2**. The valve will thus take a balanced position, which will thus depend from the rate of opening of the shutter **5**. Consequently different balanced positions of the valve **1** will be obtained by opening more or less the shutter **5**. It should be noted that the stress necessary for opening or for closing the shutter **5** can be made considerably weaker than that which is necessary for opening or closing directly the valve **1**.

In the case of Figures 1 to 3, the shutter **5** is directly arranged on the body **9** of the valve box, but it is obvious that the shutter **5** could be located at any distance from the said box **9**. In this case the amount of gap **10** can be adjusted in order to render the displacements of the valve **1** as progressive as desired, the displacement of the disc **2** determining a passage of liquid from chamber **7** to chamber **8** through the gap **10**. It should be noted that, since the ring **11** is removable, the greatest opening to be allowed for the valve **1** can also be adjusted. The width of the gap **10** can also be adjusted by providing a conduit for short-circuiting the same and connecting the chambers **7** and **8**, the said conduit can be of adjustable section.

The device shown in Figures 4 and 6 shows the above described device applied to a liquid gauging-dispensing device. In both devices shown on the one hand in Figures 1 to 3 and

on the other hand in Figures 4 to 6 the same parts are described by the same numerals. In Figures 4 to 6 the disc is shown under the form of a tight piston, the gap 10 is replaced by a calibrated orifice, the shutter 5 is formed by a valve subjected to the action of a spring 15 and the valve 1 acts as the output control valve of the device. The predetermining device of the apparatus, not shown, operates a cam 21, coacting with a lever 25, which controls the displacements of the shutter 5.

Figure 4 corresponds to the full output position of the dispensing apparatus.

Figure 5 corresponds to the reduced output position in which the valve 1 is closed and the liquid continues to flow through the aperture 10 and through the section of the passage which still remains free between the shutter 5 and its seat.

Figure 6 corresponds to the position in which the liquid dispensing apparatus is stopped, the valve 1 and the shutter being completely closed.

The device shown affords a very simple means for operating the valve which controls the output of the dispensing apparatus. The mechanical means heretofore in use are dispensed with thus avoiding many of the actual disadvantages and particularly the following:

(*a*) In the case of high output dispensing apparatus the direct control of a large size valve entrains considerable stresses, thus necessitating strong mechanical means.

(*b*) In some cases, it might be interesting to separate the predetermining device from the valve 1 itself, which is advantageously located at a non negligible distance from the said mechanism, the operation by usual mechanical means taking thus place in difficult conditions.

(*c*) The operation by mechanical means of the valve 1 entrains reactions of the said valve upon the mechanism, particularly in the case of water impacts which can render the adjustment unsafe if a balanced valve is not used.

(*d*) The closing speed of the valve 1 is difficult to adjust.

RAYMOND LUCIEN RAMBERT.

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BY A. P. C.

R. L. RAMBERT
VALVE CONTROL DEVICE
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438,103
2 Sheets—Sheet 1

Fig. 1

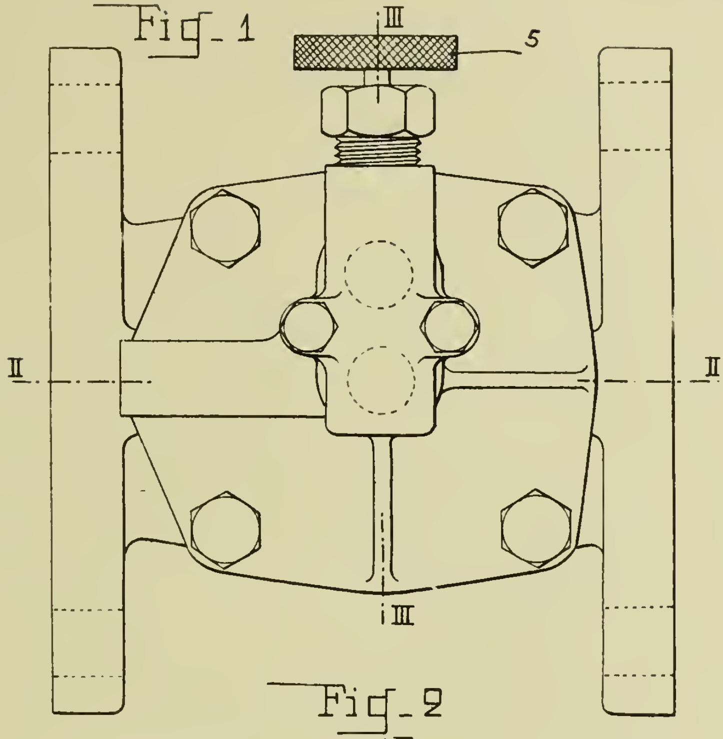
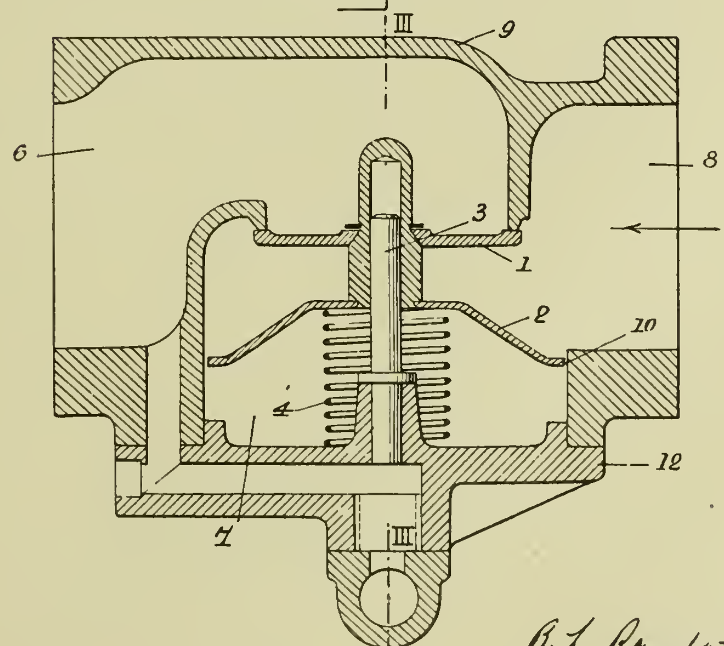


Fig. 2



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2 Sheets-Sheet 2

Fig. 4

Fig. 5

Fig. 6

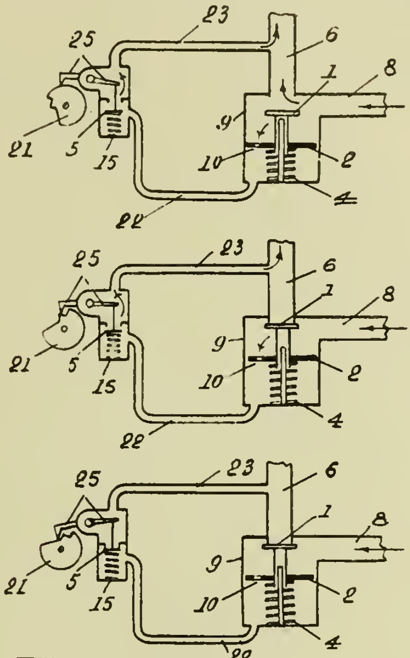
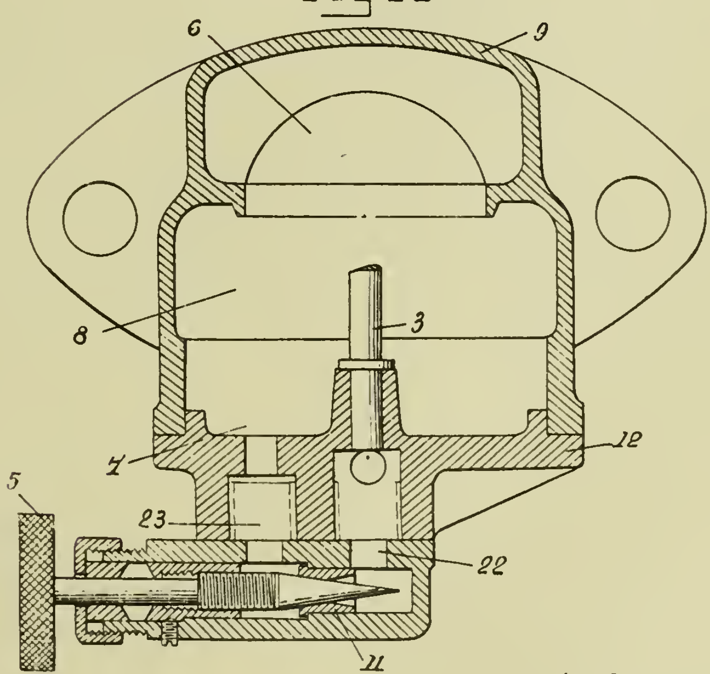


Fig. 3



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Published July 13, 1943 Serial No. 442,132

ALIEN PROPERTY CUSTODIAN

METHOD OF PRODUCTION OF COPPER AMMONIDE

Felix Annet Honoré Verdeaux, Bordeaux, France; vested in the Alien Property Custodian

No Drawing. Application filed May 7, 1942

This invention relates to a method of production of copper ammonide.

It is well known that the attack of metallic copper in the form of planing or other chips by ammonia in the presence of air leads through a complex reaction to the obtention, in the laboratory, of a product which is called copper ammonide.

The present invention relates to a method for the production of copper ammonide, this method being characterized by the fact that ammonia in a gaseous state or in solution is caused to act upon hollow copper shot, which insures a more economical and easier commercial manufacture.

Hollow copper shot is generally obtained by direct melting and refining of copper refuses or ingots of any form with an addition of sulphur. It is in this manner that it is prepared for the production of copper sulphate.

The so prepared shot appears in the form of hollow spherules with a thin wall which are particularly well suited for the attack by a liquid or a gas.

The invention covers the above defined method regardless of the apparatus which is used for carrying out the said method and of the use which the prepared copper ammonide is intended for.

FÉLIX ANNET HONORÉ VERDEAUX.

Published July 13, 1943 Serial No. 463,175

ALIEN PROPERTY CUSTODIAN

WATER HEATER

Willi Brandl, Zurich, Switzerland; vested in the Alien Property Custodian

Application filed October 24, 1942

This invention relates to a water heater for the production of hot water of the type wherein the water is heated during its passage through a heating element. The invention especially refers to that type of apparatus which is provided with a fresh water chamber, a hot water chamber and an upcast pipe connecting heating element and hot water chamber.

According to the present invention the supply of water to the fresh water chamber is controlled by the water level in the said fresh water chamber and also by the water level in the hot water chamber.

The form of construction shown in the accompanying drawing prevents the mixture of hot and cold water which often occurs in known constructions of water heater. According to this invention water is heated after every discharge of hot water. This invention also obviates the necessity to make use of thermostatic devices and the like.

One preferred embodiment of the invention is diagrammatically illustrated in the accompanying drawing.

Fig. 1 is a sectional elevation,

Fig. 2 is a view of a detail, and

Fig. 3 is a top view of another detail.

The apparatus shown in the drawing consists of a cylindrical casing 1 provided with a bottom 2 and a cover 3. Above the wall 4 there is provided the fresh water chamber 5. The cold water enters chamber 5 through a pipe 6 connected to the main supply pipe 7. The outlet opening 9 of pipe 6 is controlled by a valve 8 which is actuated by the float 12 by means of lever 11 and an adjustable screw bolt 10. From chamber 5 the water flows through pipe 13, coil 13′, pipe 14 into the heating element 15. Element 15 is surrounded by a casing 16 so as to reduce the dissipation of heat. Heating element 15 is of cylindrical shape and an electric heating body 18 is arranged on its cylindrical wall. Heating body 18 is connected to the mercury switch 20 (see Figure 2) and thereby to the electrical mains not shown in the drawings. In order to further minimize the dissipation of heat an intermediate cylinder 19 is disposed between heating element 15 and casing 16 so as to leave an annular chamber 21 around heating element 15. Heat which might pass through the casings 16 and 21 is not lost, as it is transmitted to the water contained in chamber 24. An upcast pipe 22 leads from the heating element 15 through the hot water chamber 24 upwards into a pipe 25 disposed within tube 26. Tube 26 ends above the water level in the chamber 5. A lagging of cork or of other suitable material 27 is packed between the walls of the chamber 24 and the outer casing 1. The chamber 24 is connected at its lower end by a pipe 28 to the tap 30 which is also connected to the main supply pipe 7. Hot water is fed to the outlet 31 by actuating tap "W" and cold water by turning tap "K".

A float 33 is arranged in the hot water chamber 24. The said float bears a vertical rod 34 provided with a knob 35 which is adapted to bear against the upper end of a tub 36. A double-armed lever 38 cooperates with the knob 35. A rod 39 is secured to the said lever 38 at its end lying opposite to the knob 35. Rod 39 is guided in a vertical tube 40 and swingably connected at its lower end to a plate 42. Plate 42 is excentrically and rotatably mounted on a bolt 43 and bears the mercury switch 20. Bolt 43 is fixed to a lap 44 secured to the outside of chamber 24. Above the lever 38 there is provided a screw 47 screwed into a lap 46. Screw 47 is adapted to cooperate with the lever 38. Lap 46 is fixedly secured to the float lever 11 which is rotatable about pin 49. Double-armed lever 38 is rotatable about bolt 50.

The operation of the above described apparatus is as follows:

When the cold water tap K is turned on, the cold water coming from the supply pipe 7 flows through the outlet 31. When, however, the hot water tap W is turned on, hot water coming from the hot water chamber 24 flows through pipe 28 to the outlet 31. As the water level in the chamber 24 sinks, float 33 sinks also until knob 35 bears against tube 36 as shown in Figure 1. Plate 42 which is excentrically mounted on bolt 43 swings by gravity in anti-clockwise direction and pushes rod 39 upwardly, thereby turning lever 38 about its axis 50 until one arm of the said lever 38 bears against knob 35. In this position of the switch 20 the electrical circuit to the heating coil 18 is closed. Heating coil 18 heats the water contained within the element 15 to the desired temperature. When this temperature is reached, the water is forced through pipe 22 in the direction of the arrows shown in Figure 1. The water flows in the hot water chamber 24. Cold water flows from chamber 5 through pipe 13 into the heating element 15. When the water level in the chamber 5 sinks, float 12 opens valve 8 and cold water flows from the main supply pipe 7 into the chamber 5. The water column contained in the pipe 13 and in coil 13′ has enough inertia to force the hot water through the pipe

22 upwardly without the formation of steam and in such a way, that a return swing of the column of water in the pipes 13 and 13' does not occur.

When the hot water tap W is closed there is still water flowing through pipe 6, chamber 5, pipe 13, heating element 15 and pipe 22 into the hot water chamber 24 and this until chamber 24 is nearly filled. Then float 33 is able to swing lever 38 about its axis whereby plate 42 is swung about bolt 43 and the electrical circuit is opened by the mercury switch 20. The flow of preheated water stops and float 12 closes valve 8 as soon as the water level in the chamber 5 has reached the desired height. There is now no water flowing through the apparatus and chamber 24 is filled with hot water.

Should there be for any reason an interruption in the flow of water in the parts 6, 5, 13, 14, 15, 22, 25 of the apparatus when the heating element is switched on, the heating coil 18 would be damaged. In order to prevent this, screw 47 of the lever 11 presses upon the double-armed lever 38 as soon as float 12 sinks, thereby swinging lever 38 in such a way about its axis 50 that rod 39 tilts plate 42 and mercury switch 20 so as to interrupt the electric circuit. As soon as the water flows again float 12 is lifted and lever 38 is free to move. Switch 20 closes the electric circuit to the heating coil 18 and the apparatus continues to work until chamber 24 is filled with hot water.

Cover 3 and bottom 2 as well as the other covers 52 and 53 allow an easy cleaning of the chambers and pipes. In the entire device there are no valves except for the taps K and W disposed outside of the apparatus. It is obvious that any other switch might be used instead of the mercury switch 20 above referred to. Instead of an electrical heating element provision might be made for heating the water by means of gas or coal. The hot water flowing upwardly through pipe 22 heats the water contained in the chamber 24 and keeps the same at a constant temperature.

At least one further hot water container communicating with chamber 24, disposed outside the casing 1 might be connected to the tube 28. When hot water is withdrawn from chamber 24 of from one of the said communicating containers, the device begins to work as above described. This construction has the advantage that only one central water heater must be provided for several taps.

Float 12 is adjusted by screw 10 in such a way, that the water level in the chamber 5 corresponds substantially to the upper end of the upcast pipe 22 so that shortly after starting the heating of the heating element 15 hot water leaves pipe 22 and flows into chamber 24. It is of course also possible to adjust float 12 in such a way, that the water level in the chamber 5 lies above or below the outlet opening of pipe 22. In this manner the temperature of the hot water can be adjusted. When the level of the water in the chamber 5 is below the upper end of pipe 22 a temperature of 97° C. can be attained. Inversely, when the water level is below the upper end of pipe 22 lower temperatures are obtained.

Below the hot water chamber 24 there might be provided a heating plate conveying heat to the bottom of the said chamber 24. This heating plate can be arranged to be switched on together with or separately of switch 20.

WILLI BRANDL.

PUBLISHED

JULY 13,1943.

BY A. P. C.

W. BRANDL

WATER HEATER

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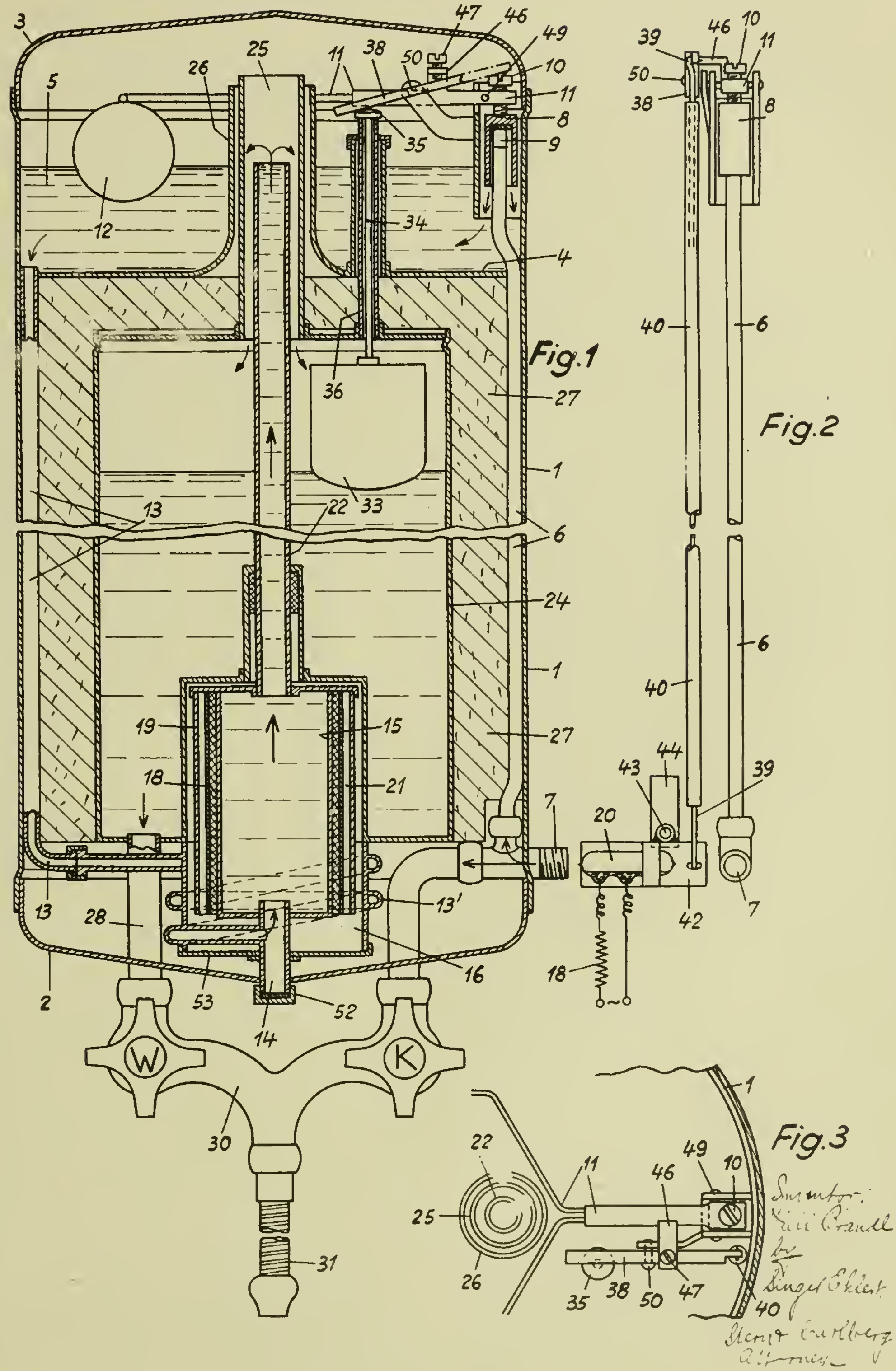

Published July 13, 1943

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ALIEN PROPERTY CUSTODIAN

COUPLING FOR PIPING

Jacques Muller, La Garenne Colombes, France;
vested in the Alien Property Custodian

Application filed November 27, 1942

This invention relates to couplings for piping or tubing such as pipes, tubes and hoses and has more particular reference to the type of such couplings comprising a sleeve-like member compressible intermediate the outer surface of the piping and rigid tightening means encompassing said sleeve and adapted to clamp it into tight contact with the piping surface.

An object of the invention is to provide a piping coupling of the aforesaid type having such an improved structure as to secure after tightening a leak-proof contact between the compressible or plastic sleeve and the piping while preventing undue disengagement of said sleeve and while also preserving to the coupling a certain amount of suppleness, thereby avoiding breakages due to hammering stresses of the metal under the influence of vibrations or ramming blows.

Another object of the invention is to provide an improved piping coupling wherein the tight contact between the sleeve and the piping can be accurately adjusted by properly setting the assembly pressure of the tightening means and, once set, said pressure remains constant under all circumstances.

A further object of the invention is to provide an improved piping coupling wherein the sleeve comprises two parts adding their respective effects, one of said parts being formed with an annular bead or bulge capable of becoming compressively squeezed owing to its inherent resiliency into leak-proof contact with the adjoining surfaces of the piping and a union housing said sleeve.

A still further object of the invention is to provide an improved piping coupling whose compressive and plastic sleeve is held clamped between the piping and a union under the action of rigid tightening means including a nut, the latter being advantageously of cap shape and extending pressure both on said union and also gradually on the sleeve through the medium of an interposed braking member so arranged as to become distorted for partaking of the sealing effect and precluding leakages.

A still further object of the invention is to provide a piping coupling wherein the braking member is advantageously in the form of a distortable metal ring including a cylindrical portion adapted to partly sheath the sleeve and a frustum-shaped portion adapted to cooperate with the trailing end of the sleeve and to bite and anchor itself into the material of which the piping is made so as to procure proper leak-proofness even when the piping undergoes vibrations, any tendency to disengagement being automatically checked by said braking ring.

A still further object of the invention is to provide a piping coupling wherein the sleeve may be made up of two parts, the leading part being adapted to become distorted into leak-proof contact with the piping and union fitting thereover while the trailing part is intended to fulfill the dual function of a sealing member and a vibration absorber or damper, the distortable portion of the braking member being engageable through the space between said parts.

A still further object of the invention is to provide a piping coupling wherein in one of the embodiments the sleeve has a lip at its trailing end adapted to cooperate with the frustum-shaped portion or flange of the braking ring to assist in securing adequate proofness against leakages and undue disengagements.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel arrangement and combination of parts that will now be described more in detail with reference to the accompanying drawings exemplifying embodiments of the same and forming a part of the present disclosure.

In the drawings—

Figure 1 is an axial sectional view illustrating a coupling made in accordance with the invention and fitted to a pair of pipe sections abutted end to end, assuming the parts to occupy their non-tightened positions on the left hand side of this illustration and their tightened positions on the right hand side.

Figure 2 is a view similar to Fig. 1 illustrating constructional variations, the sleeve being shown in two parts on the left hand side of this illustration and in one part on its right hand side, respectively in untightened condition in the upper half and in tightened condition in the lower half of the figure.

Figure 3 is a perspective view of a ring comprising a plain cylindrical portion and a notched frustum-shaped portion, said ring being insertable as a braking element into a cap nut so as to cooperate with the compressible sleeve.

Figures 4, 5 and 6 are sectional views of constructional modifications of the coupling shown in Fig. 1, each of these modifications comprising metallic gaskets.

Figure 7 is an axial sectional view of a coupling adaptable to hoses.

Like reference numerals designate like parts throughout the several views.

Reference being first had to Figs. 1 and 2, the

numerals 1, 2 designate a pair of pipe sections mutually aligned and abutted end to end. 3 is a union or nipple having in half longitudinal section an anvil-like outline as shown and provided with two threaded portions 4, 5 on its outer face and with oppositely directed outwardly divergent tapers 6, 7 on its inner face. 8, 9 are a pair of cap nuts whose tapped skirts can be screwed to a varying extent over the threaded portions 4, 5.

10, 10 designate a pair of compressible or plastic sleeves adapted to be clamped into tight contact intermediate the piping 1—2 and the union 3. Each sleeve 10 is provided at one end (which may be called the leading end) with an annular bead or bulge 11 and comprises an annular head or body 12 at the opposite end (which may be termed the trailing end). The head and bead are interconnected by a tapering portion 13. The degree of taper or conicity of this portion 13 with respect to the horizontal is smaller than that of the inner surfaces 6, 7 of the union 3.

14 designates a clamping or braking ring shown separately in Fig. 3 and comprising a plain cylindrical portion 15 and a frustum-shaped portion 16 formed with spaced nicks or notches 17 which enable it to become distorted when clamped into position.

In the constructional form illustrated in Fig. 1, the sleeve 10 is formed at its trailing end beyond its annular head 12 with a concentric lip 18 which slants off in a direction opposite to that in which the frustum-shaped portion 16 of the braking ring 14 slants. In the illustration shown by the left hand side of Fig. 2, the sleeve 10 is made up of two separate parts having an intermediate gap in which is received a portion of the braking ring 14. Each part of the sleeve 10 partakes of the tightness and, moreover, the head part 12 also acts to absorb or damp vibrations.

The way of assembling a coupling as shown in Figs. 1 and 2 is as follows: Once the pipe sections 1, 2 are abutted end to end and engaged through the union 3 which does not require any special trimming, the leading or beaded ends 11 of the sleeves 10 are inserted at 6, 7 and the cylindrical parts 15 of the braking rings 14 are engaged over the sleeve heads 12. The nuts 8, 9 are afterwards screwed upon the threaded ends 4, 5 of the union 3. Owing to the ensuing compression, the beads 11 penetrate into the conical recesses 6, 7 and provide a first tight joint while the heads 12 which are also compressed provide a second tight joint. On completion of the clamping process, the frustum-shaped portions 16 of the braking ring 14 bite into the material of which the pipe sections are made and so become anchored to them. Such anchorage is completed in the form shown in Fig. 1 by that of the lip 18 which is compressed and brought closer to the head 12 by the nut push while in the form shown in Fig. 2 the separate head 12 forms an additional zone providing tightness and compression between the braking ring 14 and the piping. This permits the frustum-shaped portion of the braking ring 14 to be arranged in either direction or alternatively the braking ring to the duplicated, in opposite directions without any risk of disengagement. When the sleeve is made in two parts, there may be provided a threaded sheath 19 adapted to be screwed into the bore of the nut 8 and to cooperate with a washer 20 so as to clamp together the sleeve 10 and the braking ring 14.

In the modification illustrated in Fig. 4, there is provided between the lip 18 and the sleeve head 12 a hollow annulus 22 of circular cross section capable of resiliently flattening itself to an oval contour under the push exerted by a braking ring constituted by a conical washer and thus of providing an additional tight contact.

In the other modification shown in Fig. 5, the annulus 22 is replaced by a similarly behaving annular member 23 having a trough shape in cross section whose free edges 34, 35 are adjacent the piping 1 and can thus bite into it and so become anchored therein for checking any undue motion in either direction.

In the other modification shown in Fig. 6, the same action is performed by a set of resilient gasket washers 24 disposed in substantial parallelism and which by anchoring themselves into the wall of the piping 1 check any tendency of this piping to move in a direction opposite to the one in which motion is prevented by the action of a cooperating washer 21 abutted against the outermost face of the lip 18.

It will be understood that in the constructional forms shown in Figs. 4, 5 and 6 which are particularly concerned with rigid piping or tubing, the spheroidal shape of the bead 11 formed on the leading end of the sleeve 10 ensures proper leak-proof tightness even when the piping 1 has a slight obliquity with respect to the union 3.

The constructional form shown in Fig. 7 is applicable to a hose or soft tubing which is internally lagged with an elongated bushing 30 having one of its ends splayed at 31 over an inner shoulder 34 on the union 3. The bushing 30 may have a screw thread 32 of relatively large pitch on its outer face to engage a correspondingly tapped portion on the inner face of the hose 1. In this form, the compressible sleeve has axially extending slits 33 cut through its beaded leading end and over a portion of its tapering wall but its trailing end has no lip. The purpose of these slits is chiefly to enable the bead to be more strongly clamped to the union. The body portion of the sleeve 10 is formed with an inner annular recess 25 of angular outline to receive a plastic gasket 26 held by a clamping ring 27. This gasket precludes any fluid leakage from the rear part of the inside of the coupling since in this construction the sleeve is mainly adapted to exert a clamping effort rather than to provide tightness.

In the left hand side of Fig. 7, the clamping ring 27 is a mere annulus housed in the cap nut 8 and abutted against the adjacent edge of the plastic gasket 26. On the contrary, in the right hand side of Fig. 7, the clamping ring 27 is provided with an extension 28 encompassing the peripheral surface of the gasket 26 and abutted against a shoulder 29 formed on the periphery of the sleeve 10. This ensures a still better clamping effect.

The arrangement shown in Fig. 7 is applicable to rigid pipings subjected to vibrations in which case the bead 11 ensures both tightness and a holding effect while the gasket 26 absorbs or damps the vibrations.

It will be understood that owing to the aforesaid constructions, the objects of the invention are properly fulfilled since when set into position each compressible and plastic sleeve 10 is invariably held in tight and leakproof contact with the adjacent inner and outer parts while keeping its inherent resiliency, thereby preventing undue disengagement and breakages under stresses such as vibrations, fluid hammering or the like which might otherwise cause the metal parts to become

brittle in the long run. In each constructional form, the bead on the leading end of the plastic sleeve is squeezed or resiliently compressed into perfectly tight contact and the leak-proofness is supplemented by the cooperation of the trailing end of the sleeve and piping. Moreover, provision of the braking member (which may be single or multiple) renders the coupling still more secure where somehow the nut might give way since besides sheathing the trailing end of the sleeve, said braking member is automatically anchored to the piping by flattening itself towards a plane at right angles to the longitudinal axis of the union. When provided, the braking member or ring maintains adequate pressure of the sleeve on the piping and union regardless of vibrations, while not curtailing the inherent pliability of the coupling. It will be understood that any undue disengagement is inhibited since any stress liable to cause it would bring about a deeper anchorage of the braking ring edge into the piping. This is due to the location of said edge to the rear of the sleeve so that if dragged by the piping, the braking ring would be brought closer to true perpendicularity and would thus still more bite into the piping.

The lip provided on the trailing end of the sleeve particularly where the latter is made of a metallo-plastic substance also assists in the attainment of perfect anchorage and tightness by cooperating with the braking ring.

Where the sleeve is built up of two parts, its body or head portion acts as a vibration damper and the other aims are also reached.

The sleeve might be grooved or fluted to prevent it from creeping or skidding with respect to adjoining parts but in all events breakage due to repeated hammering stress on the metal is precluded by the fact that such grooves or flutes would be located in a damped part.

All such and similar variations are included in the broad wording used in the subjoined claims wherein the word "piping" is also meant to include all kinds of pipes, tubes, hoses and like tubular lines or containers while the word "sleeve" involves a sleeve made bodily or in built up fashion of any suitable material capable of behaving as described for the purpose set forth.

JACQUES MULLER.

PUBLISHED

JULY 13, 1943.

BY A. P. C.

J. MULLER

COUPLING FOR PIPING

Filed Nov. 27, 1942

Serial No. 467,153

2 Sheets-Sheet 1

FIG. 1

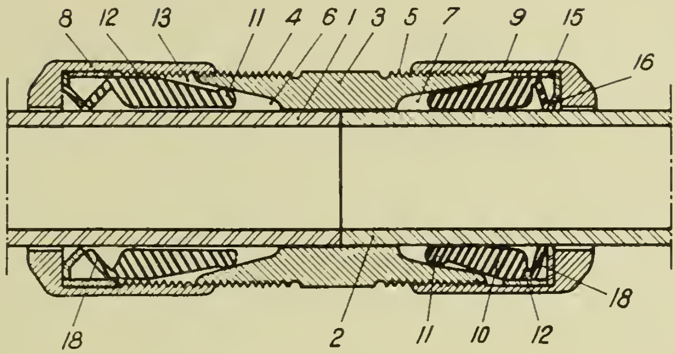
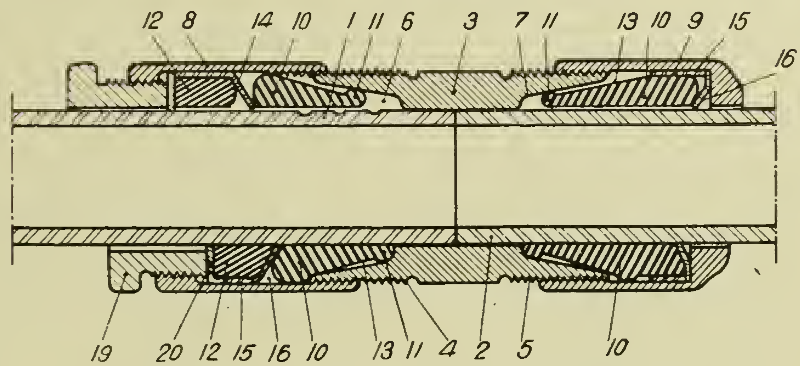


FIG. 2



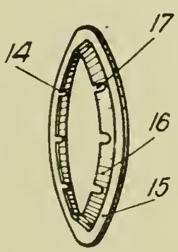


FIG. 3

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FIG.7

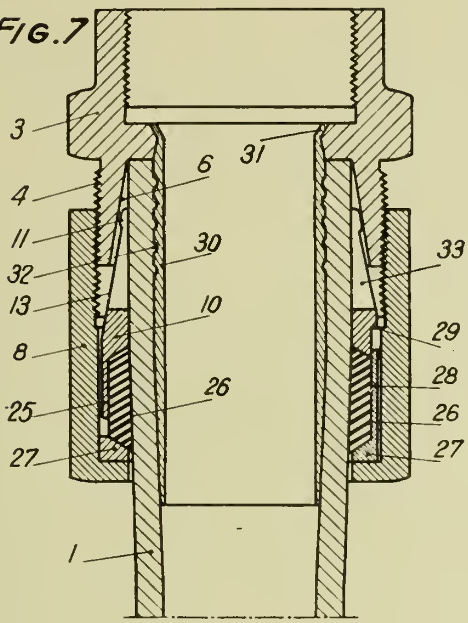


FIG.4

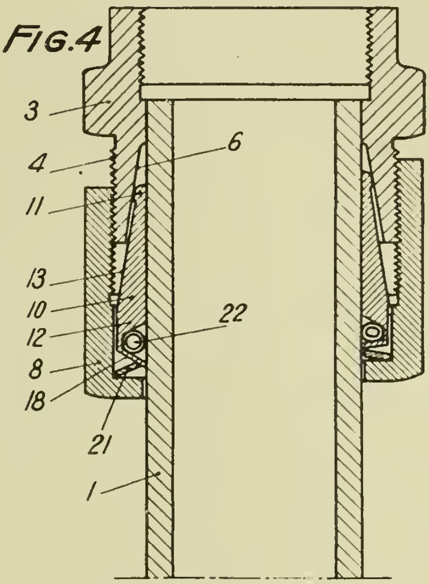


FIG.5

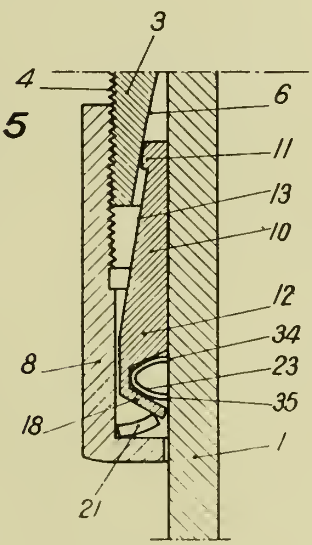
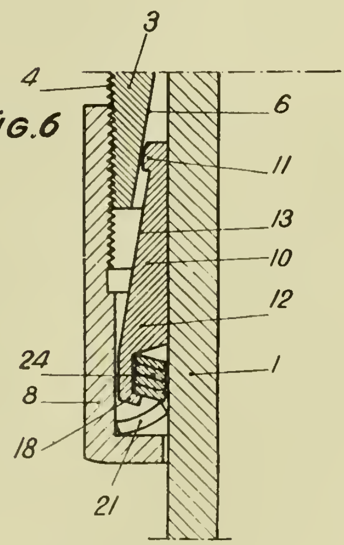


FIG.6



Inventor,
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ALIEN PROPERTY CUSTODIAN

GEAR WHEELS FOR THE DRIVE OF PLANING MACHINES OR THE LIKE

Charles William Berthiez, Paris, France; vested in the Alien Property Custodian

Application filed December 4, 1942

When it becomes necessary to make gear wheels of very large size, if they are to work at relatively high speeds, under considerable loads and if their direction of rotation is reversed at full speed, very serious drawbacks are experienced due to the considerable inertia forces that are developed, the energy to be absorbed or to be transmitted being directly proportional to the acceleration and to the mass.

This is for instance the case of wheels made of a molded material (cast iron or steel) which have a very great inertia (due to their size and to their mass) and furthermore which are as a rule more or less unbalanced.

Such wheels have been used up to the present time by the machine makers, in particular for the control and the drive of the tables of planing machines. But, especially in this last mentioned case, with the requirements of modern manufacturing and the use of high-speed cutting-steel which have led to a considerable increase of the cutting and return speeds, very great difficulties are experienced due to the fact that the drawbacks above pointed out involve the following conditions:

(*a*) They reduce the precision of the motion reversing;

(*b*) They increase the time necessary for this reversing and

(*c*) They produce in the circuits of the motor which drives the machine a very important current rise which makes it necessary to increase very much its size, thus further accentuating the inertia of rotor of the motor and also increasing the price of the motor and of the cables thereof, while involving a supplementary consumption of current which constitutes a prominent drawback.

These various drawbacks lead to eliminating more or less important fractions of the work at both ends of the stroke so that it is no longer possible to use the whole of the displacement of the table and relatively long periods of time are lost, which consequently reduces the efficiency of the machine.

Furthermore, the unbalancing of the gear wheels tends to produce vibrations which deteriorate the surface of the piece that is being machined. Finally, the resistance coefficients of molded materials lead to very important modules of the teeth which, combined with defective balancing, makes it impossible to ensure a smooth and continuous drive.

In order to obviate these drawbacks, a solution has already been proposed which consists in welding over a wheel of molded material (cast iron for instance) a ring of high resistance steel. Figures 1 and 2 of the drawings show gear wheels of this kind, Fig. 1 corresponding to the case of a wheel having two webs and Fig. 2 to the case of a wheel having a single web.

However, this solution is far from being perfect. Indeed it permits of obtaining a smoother drive by reduction of the module of the teeth (due to the high resistance of the material which constitutes the ring forced on the molded wheel); but, on the other hand, it does not permit of substantially reducing the diameters since for a given torque, the tangential stresses are inversely proportional to the diameters. Furthermore, the composite wheel thus made is still heavier than the wheel made wholly of cast iron or of molded material. Under these conditions, the above mentioned drawbacks remain in their greater part.

The object of the present invention is to provide a gear wheel the inertia of which is reduced to a minimum and which can be easily balanced.

With this object in view, according to an essential feature of my invention, the gear wheel or gear element includes a rim made of very thin and high resistance steel, welded to sheets of ordinary steel which constitute webs, themselves welded to the hub also made of ordinary steel, stiffening rays being further eventually incorporated in the structure.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings given merely by way of example and in which:

Figs. 1 and 2, as above stated, are diagrammatical views showing known wheels given by way of comparison;

Fig. 3 is a transverse sectional view of a gear wheel made according to the invention, this section being made in a plane passing through the axis of revolution of the wheel;

Fig. 4 is a section corresponding to Fig. 3 but in a plane at right angles to the axis of revolution of the wheel;

Fig. 5 is a sectional view analogous to Fig. 3 but showing another embodiment of the invention;

Fig. 6 is an elevational view corresponding to Fig. 5.

As shown by these drawings, a wheel according to the present invention includes a rim 1, of high-tensile steel, of rectangular section,

which is welded at 2 on a web 3 (embodiment of Figures 5 and 6) or on two webs 4 and 4' (embodiment of Figures 3 and 4), said web, or webs, being made of ordinary steel sheet. On said web, or webs, there is welded at 5 a hub 6 of ordinary steel. Furthermore, in order to eliminate resonance phenomenons, the wheel may be fitted with stiffening rays or frames 7. In the embodiment of Figures 3 and 4, these parts 7 are apertured while in the embodiment of Figures 4, 5 and 6, they are made solid. These rays of frames are also welded at 8 to rim 1 and at 9 on hub 6. They are welded at 10, 9 and 8 to the inner walls of the webs, to the outer surface of the hub, and to the inner surface of the rim respectively.

The combined wheels made as above described may undergo a thermal treatment after welding of the different parts thereof, in order to obtain homogeneity and the desired characteristics of the matter.

The preceding explanations have pointed out the advantages of gear wheels made according to the invention over the gear wheels made prior to this invention, including those having a steel ring forced upon the molded wheel body (Figures 1 and 2) and, of course, the wheels which are entirely made of molded material. These advantages consist chiefly in a reduction of the mass of the wheel and therefore of its inertia. They lie also in the greater facility of balancing the gear wheels thus made.

First, a defect in balancing is less to be feared in a piece which is not obtained by molding, while in the case of molded pieces it is practically impossible to prevent a defective distribution of the matter, due to air pockets, bad molding and other defects.

There is no risk of such a drawback in the case of the wheel according to the invention since the use of molded parts is wholly eliminated. A lack of uniformity in the distribution of the matter could therefore result only from the weldings but, on the one hand, the influence of such unequalities of distribution of the matter is very small and, on the other hand, it can be corrected very easily. As a matter of fact, in view of the relatively low weight of the wheel, very little is necessary for restoring a good balancing while on the contrary, with very heavy wheels such as those of Figures 1 and 2, it is necessary to add relatively great amounts of matter and this in an experimental manner, without having any certainty of reaching the full desired result.

Therefore, to sum up, the wheel according to the invention is of an inertia reduced to the minimum. It is very easy to manufacture. And it can be perfectly balanced.

Of course, the method of manufacturing above described can be applied not only to the wheels shown by the drawing but to any other kind of wheel or even of toothed sector. It might also be used with the same advantages for the manufacture of wheels without teeth, pulleys, etc. and especially when applied to machines having a reciprocating motion.

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GEAR WHEELS FOR THE DRIVE OF PLANING
MACHINES OR THE LIKE
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2 Sheets-Sheet 1

Fig. 1

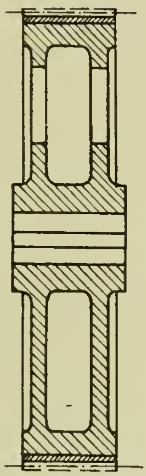

Fig. 2

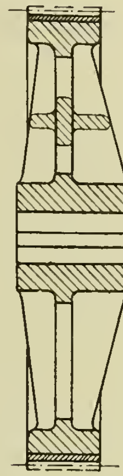

Fig. 3

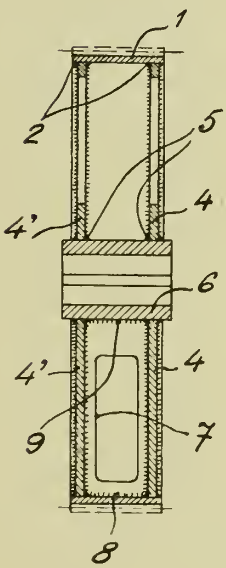

Fig. 4

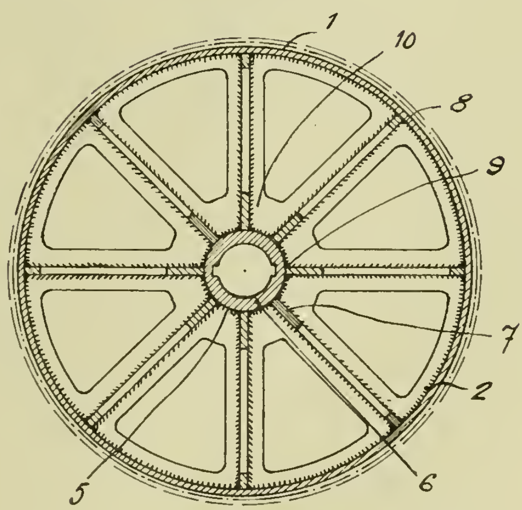

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Fig. 5

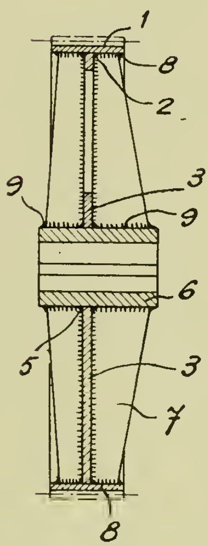
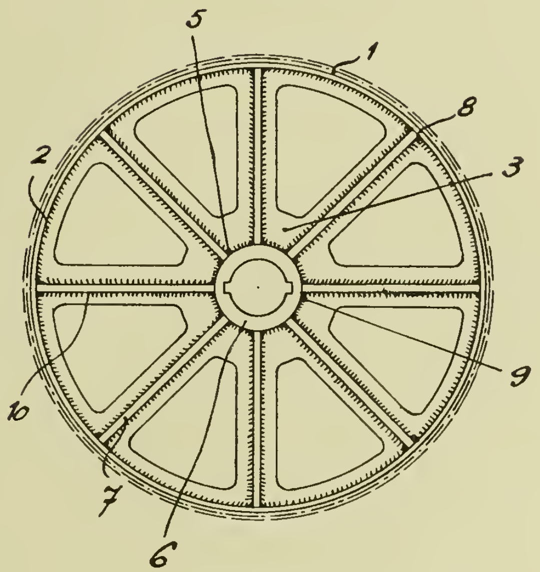


Fig. 6



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Published July 13, 1943 Serial No. 467,858

ALIEN PROPERTY CUSTODIAN

DEVICES FOR ADJUSTING THE FEED OR DISPLACEMENT OF CERTAIN PARTS OF MACHINE-TOOLS OR THE LIKE

Charles William Berthiez, Paris, France; vested in the Alien Property Custodian

Application filed December 4, 1942

The present invention relates to devices for adjusting the feed or displacement of certain parts of machine-tools or the like.

Up to the present time, the devices used for the adjustment of the feed of the tool (in a planing machine) or of the table (in a shaping machine or in a slotting machine or a punching machine for instance) were constituted either by friction devices, rack and pawl systems, connected to the main control of the machine, or by autonomous electric motors which were electrically braked (by counter current or through magnetic means) and all these devices were of a great mechanical complication and of a high cost while being rather delicate to conduct.

As a rule, the stopping of these devices was not instantaneous and a certain supplementary path was travelled over after the exact time where said stopping was to take place. Furthermore, this supplementary path was variable (in particular in accordance with the speed and the inertia of the moving parts) and it was impossible to determine it in a very accurate manner. Under such conditions, such devices did not permit of obtaining an exact and invariable adjustment of the feed of the tool or of the table.

The object of the present invention is to provide a device of the type above mentioned, which obviates these drawbacks.

With this object in view, an essential feature of the invention consists in the use of an electric motor which is mounted directly upon the feed box without any intermediate transmission and which controls an oscillating part, the amplitude of movement of which determines the value of the feed and is itself driven by a crank pin system which turns through a full revolution after each stroke of the table (for instance in the case of a planing machine) or of the tool (for instance in the case of a planing machine or a slotting machine).

According to another feature of my invention, the means for transmitting movement from the above mentioned oscillating element to the part which controls the feed includes a pawl and ratchet device, the combination of said device and of the oscillating element making it possible to avoid the necessity of reversing the direction of movement of the control motor. Furthermore, as the feed is determined solely by the adjustable amplitude of the movement of the oscillating element, there is no necessity of having the control motor stopped in an accurate manner at a predetermined point, as in the systems used prior to this invention.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

A preferred embodiment of the present invention will be hereinafter described with reference to the accompanying drawings given merely by way of example and in which:

Fig. 1 is a perspective view of a planing machine having a single vertical frame and which is made according to the present invention.

Fig. 2 is a cross section of a feed box made according to the invention; and

Fig. 3 is a sectional view on the line III—III of Fig. 2.

As shown by the drawing, in order to produce the feed, for instance in a planing machine, I make use of an electric motor 1 which is fitted on the casing 2 of the feed control device. The shaft of this motor carries an endless screw 3 which meshes with a helical wheel 4 carried by a disc 5 (Figure 3). This disc 5 carries a crank pin 6, the position of which is adjustable, in a manner which will be hereinafter described, in an elongated slot 7 provided in an oscillating piece 8 which constitutes one of the essential parts of the device according to the present invention.

This oscillating piece 8 is pivoted about an axis 9 carried by the wall of casing 2. The periphery of said oscillating piece forms a toothed sector 10 which meshes with a toothed wheel 11 rigid with a toothed wheel 12 provided with inner teeth so as to form a ratchet wheel (Figure 2).

The teeth of said ratchet wheel are adapted to cooperate with pawls 13 pivotally mounted on a disc 14 keyed on a shaft 15 journalled in bearings 16, carried by the casing of the device. On this shaft 15 there is also keyed a pinion 17, which meshes with the toothed wheel 18, the latter driving feed screw 19 which causes tool-carriage 20 to move forward a given distance.

The position of crank pin 6 in the slot 7 of oscillating piece 8 is adjusted by means of an operating hand wheel 21 located on the outside of the casing and rigid with a spindle 22, the inner end of which carries, fixed thereon, a bevel pinion 23. This pinion 23 meshes with another bevel pinion 24 keyed on a shaft 25, having a threaded portion upon which can move a nut 26 rigid with a block 27, in which crank pin 6 can turn and which can slide in slot 7.

When motor 1 is in operation, it drives through the transmission above described, crank pin 6, which then moves along a circle shown in dot-and-dash line at x—y—z—w of Figure 2. As a consequence of this, oscillating sector 8 is caused

to oscillate between two extreme positions (the extreme positions of the axis of symmetry of oscillating piece **8** are shown in dot-and-dash lines in Fig. 2). Under these conditions, the amplitude of the movement of the oscillating piece will remain the same as long as the eccentricity of crank pin **6** is not changed and consequently the rotation of wheel **12**, disc **14** and feed screw **19** will also remain the same as long as the eccentricity of crank pin **6** is not varied.

If, for instance, motor **1** runs in such manner as to drive wheel **4** in the direction of arrow f (Figure 2), oscillating piece **8** will move in the direction of arrow f_1 and ratchet wheel **12** in the direction of arrow f_2, driving disc **14** which carries pawls **13**, in the same direction, together with shaft **15**. The rotation of said shaft **15** will be transmitted through pinion **17** and toothed wheel **18** to the feed screw **19** of the tool carriage.

This feed movement will take place during the portion of the movement of crank pin **6** corresponding to the circular arc x—y—z. When, under the action of the motor turning always in the same direction, crank pin **6** moves along circular arc z—w—x, oscillating piece **8** turns in the opposite direction, that is to say in the direction of arrow f'_1 (Figure 2). In the course of this last mentioned movement ratchet wheel **12** turns in a direction opposed to that of arrow f_2 and pawls **13** slide over the teeth of said ratchet wheel. In other words, when crank pin **6** moves through circular arc z—w—x, disc **14** and, consequently, shaft **15** and feed screw **19** are not driven. The feed movement is therefore stopped when crank pin **6** comes to point z and said movement can be resumed only when crank pin **6** passes at point x.

If the position of crank pin **6** in slot **7** (that is to say the eccentricity of said crank pin) is modified, the radius of circumference y—z—w—x is varied. the limit of variation being zero (crank pin **6** being then co-axial with disc **5**) and a maximum value. I thus vary the angle of amplitude α of the movement of the oscillating piece and, consequently, the angle of rotation of toothed wheel **11** and finally the value of the angle of rotation of feed screw **19** which determines the feed. Thus, the value of the feed depends exactly upon the amplitude of the movement of oscillating piece **8**, which can be adjusted to the desired value in a highly accurate and invariable manner.

It has been explained that the feed movement takes place while crank pin **6** is moving through circular arc x—y—z and that circular arc z—w—x corresponds to no movement of the transmission elements **14**—**15**—**17**—**18**—**19**. This zone z—w—x is thus available for stopping the movement of the motor at one of the ends of the stroke of the planing machine table.

Supposing that Figure 2 shows the adjustment for the maximum feed, it will be seen that zone z—w—x has at this time a minimum value. If, for instance, this feed movement corresponds to about $^{200}/_{360}$ of a revolution of crank disc **5** (circular arc x—y—z of the travel of crank pin **6**), the motor will stop at any point of the remaining $^{160}/_{360}$ of the circumference (circular arc z—w—x of the travel of crank pin **6**). In other words, it is not necessary to obtain any delicate adjustment of the stopping of the engine.

If, as in the embodiment illustrated by the drawing, I consider the case of a planing machine, the table, when reaching the end of its stroke, closes the circuit in motor **1** which starts running, crank pin **6** starting from any point of circular arc z—w—x. This crank pin travels over circumference x—y—z—w in the direction of arrow f, the feed movement beginning when said crank pin reaches point x and ending when the crank pin has reached point z. When it has moved slightly past this last mentioned point, the very movement of said crank pin causes the circuit of motor **1** to be opened through an electric device not shown by the drawing, whereby crank pin **6** stops at any point of circular arc z—w—x, where it is ready to resume its movement for a new stroke of the table.

The preceding explanations show that the invention, in addition to the very high accuracy which can be obtained in a very simple manner for adjusting the feed of the tool or all other part, has the advantage of utilizing a matter which has not to be reversed in operation except for the quick and continuous displacement of the carriages which has not been shown on the drawing as being not a part of the present invention.

The device above described and illustrated by Figs. 2 and 3 can be placed, as shown by Fig. 1, at the end of the cross piece of the planing machine. In big machines, it might also be mounted on the carriage itself.

The same device is also applicable not only to control the feed of the tool in planing machines but also to the control of the tables in shaping machines or slotting machines for instance. In a general manner, the device according to the invention can be applied to all kinds of machines of which it is necessary to obtain, at predetermined times, an accurate feed or displacement of a part of the machine.

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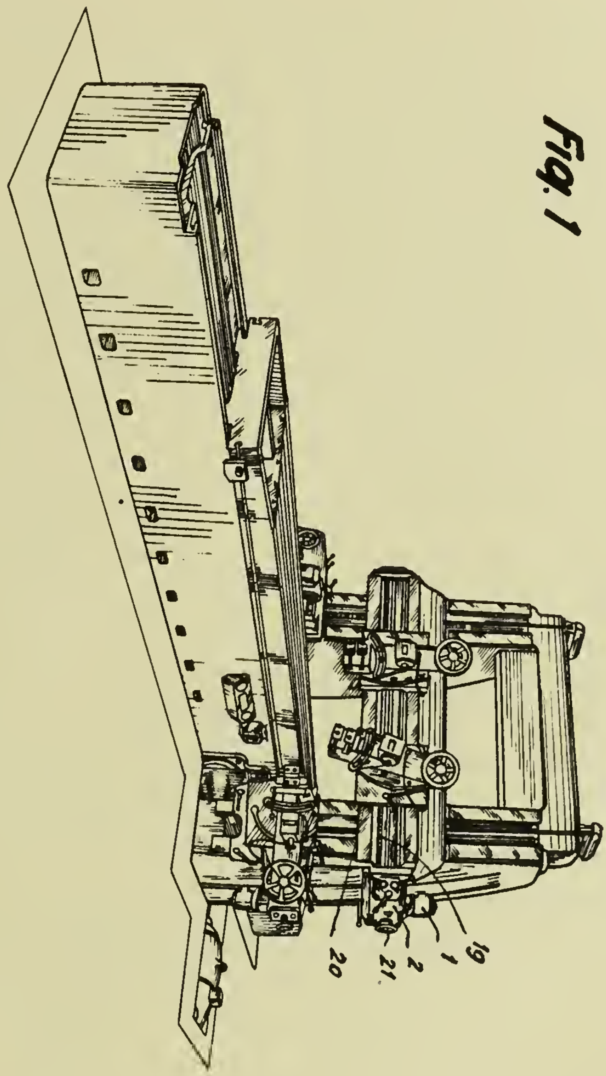

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Fig. 2

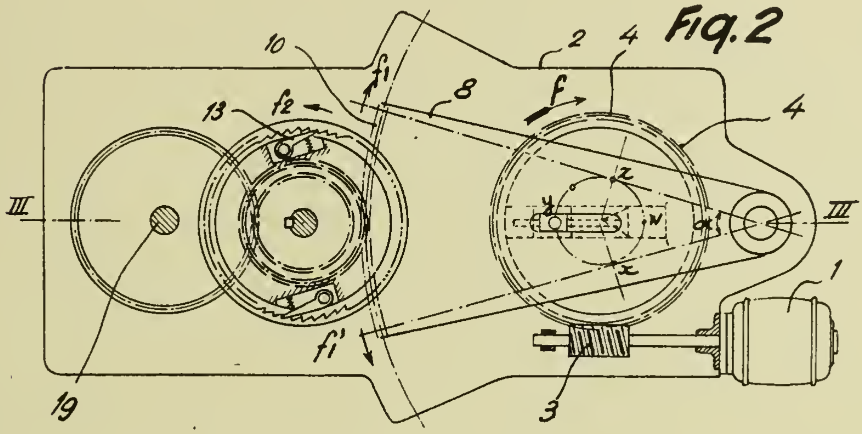
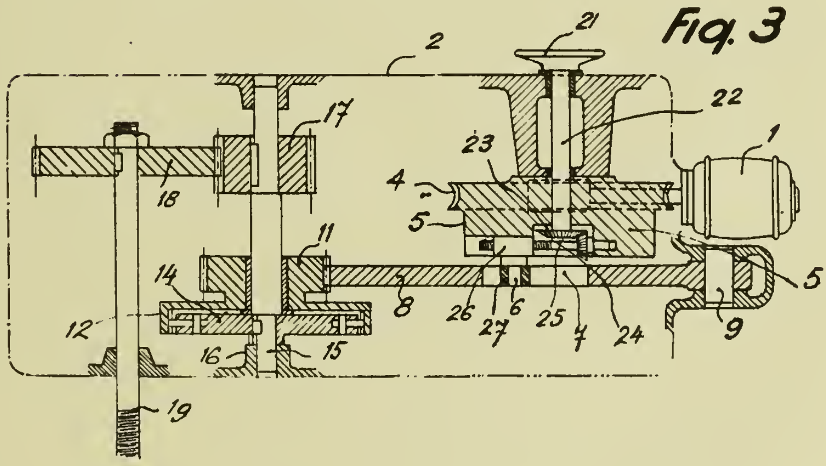


Fig. 3



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ALIEN PROPERTY CUSTODIAN

BUNDLE TYING MACHINE

Jean Joseph Martin Lambert Marchand, The Hague, Holland; vested in the Alien Property Custodian

Application filed December 15, 1942

The invention relates to an improved machine for tying a bundle of letters, books or like documents or for binding one or more other objects, of the kind as described in the prior U. S. A. Patent No. 2,198,440. This prior machine comprises a member in the form of a tying ring, intermittently rotatable always in one and the same direction during a tying operation and a clamping device mounted on said ring, which seizes the primary end of a typing-medium from a revolving support and pulls it around the articles to be tied. Furthermore means are provided for firmly connecting the adjacent parts of the tying-medium by means of a metal clip, which parts are laid together in overlapping position after the wrapping.

An important object of my invention particularly consists in the perfection of a machine of the kind mentioned in such way as to enable the machine still more to satisfy all requirements, whereas the use of it will completely attune to the ordinary practice, more particularly with regard to the nature of the applied tying-medium.

One feature of the present invention resides in the provision of an adjustable braking-arrangement by means of which the tension of the tying-medium, gripped by the clamping-device on the tying ring, can be accommodated to the strength, stiffness or to the other properties of the material, used for said tying-medium, whereas at the same time doubly adjustable means are provided to accommodate also the extent of deformation of the metal connecting clip to said properties.

According to the invention the tying-medium, coming from a bobbin, before it is led further to the revolving support, passes along a stationary abutment, against which abutment it is pressed by means of a brake-lever, pivotable on a fixed point under the action of a spring, whereby the brake-action of said lever can be varied such, that the spring may be connected to the lever in various distances from the fixed point of rotation. In this way the tension of the tying-medium may be accommodated, e. g. to the more or less flexibility of the material used for said medium.

According to another feature of the invention means are provided to equalize the deformation and the size of the connecting clip to the thickness of the tying-medium. For that purpose, the sliding matrix, which effects the deformation of the clip in co-operation with a stationary abutment, is moved by means of a lever-system actuated from a cam-shaft, said system comprising a toggle-lever, one arm of which is pivotally connected to the sliding matrix, whereas the other is pivotable in a fork, which is adjustable in the direction of the sliding movement of the matrix. Furthermore a lever, directly moved by the cam-shaft and acting on the toggle-lever through a connecting bar, is pivotably mounted in a bearing, adapted to be slidably adjusted in a transverse direction to the sliding movement of the matrix.

A further feature of the invention relates to means for increasing the solidity or strength of the clip-connection and thus to attune the same also to any relatively stiff material of the tying-medium. For that purpose the end face of the sliding matrix, situated opposite to the stationary abutment is provided with a semi-circular groove, being interrupted over a given length in the middle by a recess of greater depth transversely to the groove, such that at both sides of said recess, projecting teeth are obtained hollowed by the groove-parts, which at the pressing of the metal connecting clip will squeeze the ends of the same more than its middle part.

In providing a machine of the described character, the possibility is obtained to lead round the tying-medium or to hold fast the same throughout the complete operation of the machine with such a tension as is required with regard to the kind of material used for the tying-medium and at the same time to make the connection of the ends of it by the metal clip more or less intensive, likewise corresponding to the used material. In consequence also various material may be used for the tying, that is as well thin or thick, as also relatively stiff or flexible material. Thus also ordinary paper may be applied as a tying medium, which then is rolled or twined in the form of a string or the like and is adapted to be tied around the bundle with the same effect and in exactly the same manner.

Other advantages and features of invention will be disclosed during the description of a practical embodiment of the invention illustrated in the accompanying drawings, in which similar reference characters represent corresponding parts in all the views.

Fig. 1 is a view of the braking-arrangement for the passing tying-medium.

Fig. 2 illustrates—also in view—the adjustable mechanism for the sliding movement of the matrix, when forming the metal connecting clip. For the sake of clearness some of the principal parts of the machine are shown in both figures, although they do not relate directly to the invention.

Fig. 3–5 show same details at a larger scale.

Referring to the drawings, 1 indicates that part of the tying ring, that is visible underneath the table 2, which ring rotates above said table in the guard casing 3. The driving toothed wheel 4 is mounted on the shaft 5 and engages with the toothed rim on the outer peripheral edge of the ring. On the hollow shaft 6, the revolving support 7 is secured. The pulleys 8 and 9 are provided for the purpose of leading the tying-medium. In this figure the path of said tying-medi-

um from the bobbin 10 up to the ring 1 is clearly illustrated.

According to the invention, the tying-medium —only as an example in the following indicated as a "string"—drawn off from the bobbin 10 and passing through an opening in the framework 11, is led through a slot in a brace 13, fast connected to the frame and after that over the pulleys 8, 9, 8 and through the hollow shaft 6 up to the recess of the support 7, in which the end of the string is tightened by means of the blade spring 15 adjustable by a set-screw 14. In the brace 13 the string is pressed with friction against the flat inner side of the brace and that by means of a brake-lever 16, pivotable at 17 on a fixed point and provided e. g. with a pressing-pin 18, situated at the side of the string. A spiral spring 19 is connected at one end to the lever 16 and with its other end to a fixed point of the framework. Under the action of said spring the lever with its pin 18 continuously presses the string against the sidewall of the brace, in such way that it brakes said string during the wrapping with a certain friction, when being pulled through. The free arm of the lever 16 is provided with a number of holes 20, equally divided on its length. When the end of the spring 19 e. g. is connected to one of the upper holes, the effective part of the lever is increased for the braking action, by that the distance between the fastening-point and the point of rotation will be greater. In this way it is possible to adjust the force of braking and thus also the resulting tension, with which the string is led further through the machine, according to the thickness, strength or to the nature of the applied tying-medium.

The guiding pulley 9 is mounted at the end of a lever 21, pivotable on a fixed point under the action of a spring, for the purpose to prevent undue slack in the string e. g. when tying bundles or objects of very small dimensions. In this case the pulley 9, being normally held in its uppermost position through the tension of the string, is moved downwards by the action of the spring. In the embodiment of the invention as illustrated in the drawing, the lever 21 is provided with an abutment 22, which bears against the framework at a given lowermost position of the pulley 9, thus preventing a further movement in downward direction of said pulley. In this way it will be prevented, that the string is jammed between the sliding matrix 23 and the lower side of the table 2, when no any bundle is present in the machine.

According to Fig. 2 the matrix 23 is slidably mounted underneath the table 2 and is adapted to roll up and press together a small strip of metal, in co-operation with a stationary abutment 24. Said strip at every turn is cut from a metallic band 25, advanced in intermittent steps, and thus deformed to a connecting clip. The lever-system provided for the sliding movement of the matrix and contrainedly moved from the cam-shaft 26, is adjustable as well in the direction of the movement of said matrix as transversely to this direction. For this purpose the system is provided with a toggle-lever 27, 28, one arm 28 of which is pivotably connected to the matrix 23, whereas the other arm 27 is pivotable on a fork 29. Said fork is screwed with an inner screw-threaded part by a screw-nut on a corresponding part of a set-bolt 30, which nut serves as a safety-nut. By screwing the bolt, the fork 29 can be adjusted over a given distance in an horizontal direction. When this adjustment is effected in such way, that the fork e. g. is moved to the left in Fig. 2, then the matrix 23 is moved also to the left and the distance between the matrix 23 and the abutment 24 is increased and the reverse.

The lever 32, which is connected to the toggle-lever 27, 28 by means of the bar 31, is provided at one end with a roller, situated against the cam-disc 26 and with the other end pivotably mounted in a bearing 33. Said bearing is connected to the framework by means of bolts, which are adjustable upwards and downwards in slots of this framework. At a lowering of the bearing, thus in that case also of the point of rotation of the lever, the matrix 23 is adjusted in such way, that a greater length is cut off from the metallic band, that is moved between the matrix and the abutment. Thus it will be possible to exactly accommodate the connection of the ends of the string by the metal clip to the thickness as well as to the strength or generally to the nature of material applied for the tying-medium. Together with the adjustment of the distance between the matrix and the stationary abutment by means of the fork 29, also the deformation of the metal clip is brought to a more or less greater intensity.

The sliding matrix 23 preferably is provided, as illustrated in the drawing, at its side turned to the abutment 24 with a head 34, oscillably mounted on a fixed pin under action of a spring, whereas the free end of the metallic band 25 abuts against the end face of said head 34. In the end face a semi-circular groove 35 is provided (Figs. 3, 4), which does not extend to the full width, however for a large part is interrupted in the middle by a recess 37 of greater depth. In this way at both sides of the recess 37 projecting hollow teeth 36 are formed. Now when the matrix 23 is pressed against the abutment 24, the clip, cut from the metallic band and situated therebetween, the end of which turned to the matrix already has been curved, is rolled up, thus forming a sleeve around the overlapping ends of the string and at the same time is pressed and deformed by means of the projecting hollow teeth, giving a shape as indicated on an highly enlarged scale in Fig. 5. The middle part of the clip situated opposite the recess is only turned or rolled up, even is still adapted to freely bend outwards to a small extent, whereas both the ends of the clip are firmly squeezed round the ends of the string therebetween by the mentioned teeth and thus assure an effective tightening.

An exact adjustment of the fork 29 and the bearing 33 of the lever-system for the matrix 23 respectively enables not only to vary the distance between the matrix and the stationary abutment in correspondence with the thickness of the ends of the string to be connected, however at the same time to effect more or less intensive the deformation of the ends of the metal clip by the teeth 36, according to the nature of the material applied for the tying-medium. In this way under all circumstances an immovable connection is obtained.

It will be evident, that the provision of a separate head 34 for the matrix not always will be required, rather the end face of the matrix 23 itself, situated opposite to the abutment, may be shaped without more as described formerly for the head.

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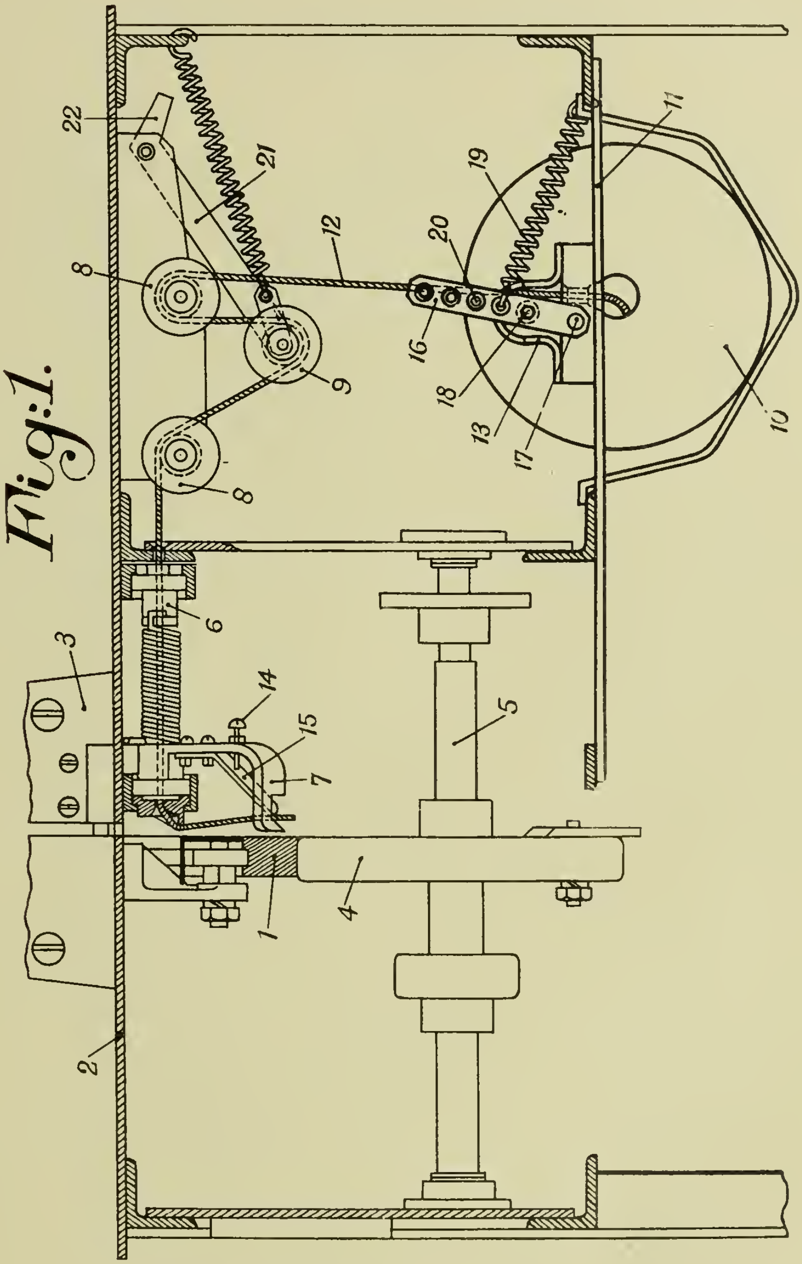

Fig:1.

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Fig:2.

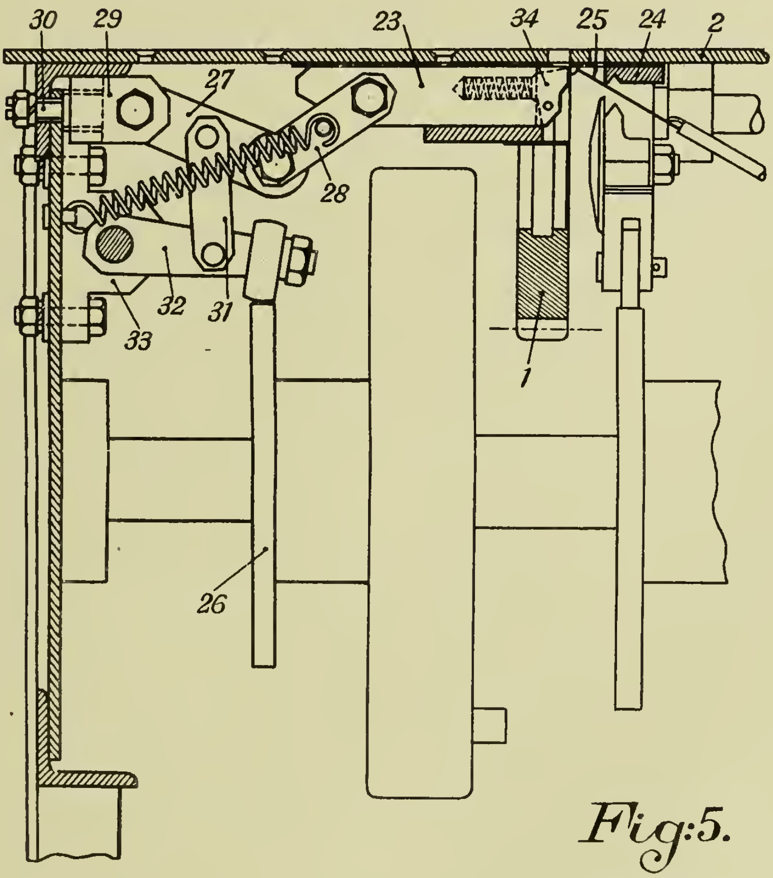


Fig:3.

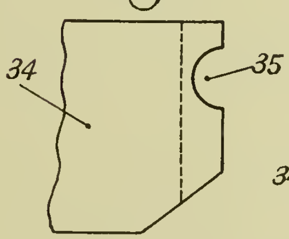


Fig:4.

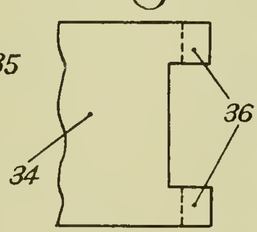
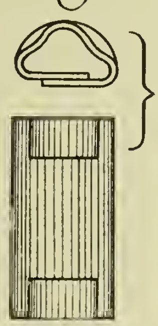


Fig:5.



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ALIEN PROPERTY CUSTODIAN

CONVEYING APPARATUS WITH ENDLESS CHAIN MORE PARTICULARLY FOR THE MECHANICAL DISTRIBUTING AND SORTING OF LETTERS, DOCUMENTS OR SIMILAR ARTICLES

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Application filed December 15, 1942

The invention relates to a conveying apparatus with an endless chain, such as may be applied e. g. in installations for the automatic transfer and sorting of postal matter, such as letters, documents or similar articles from one or more central stations to a plurality of delivery points.

It is of great importance with such type of apparatus, that the conveying of the articles takes place at a high speed, in order to increase as much as possible the output of the apparatus. Moreover, however, it is very important, that the travel of the conveying-chain is as regularly as possible, in order that the intervals of time, in which a given distance every time has to be done, on each moment and under all circumstances synchronise with the intervals between the moment of supply and delivery of the articles.

For that reason the application of an endless band or cable has to be rejected in advance, for in that case cannot be prevented, that said band or cable shall stretch and (or) shrink owing to the surrounding temperature. However the use also of an endless chain has its particular objections, which will come the more to the front, as the speed of motion is higher. Indeed, at each movement of such an endless chain, it occurs at the curves, owing to the chain being constructed with mutually connected, straight links, that at the transfer from a circular into a straight path, alternatively a retardation and an acceleration is caused on the straight part, which results in a jerking or shocking movement of the whole.

Now an object of this invention is to completely overcome said disadvantages and to provide an endless track, comprising a number of circular and straight parts, along which the conveying-chain is moved, whereby at every point of transfer from a circular path into a path according to a straight line or reverse, a special intermediate bridge-part is provided, forming a connection between the circular and straight part of the track and the course of which intermediate bridge-part is designed as a curve in such way, corresponding to the length of the chain-links, that when driving a circular part of the chain with an uniform speed, on each point of the complete track the speed of the chain will be exactly the same and equal to that of the uniform motion.

Although not at all restricted thereto, the invention more particularly is suitable for that type of sorting devices, in which the real conveyer means for the letters, documents or the like, to be distributed, consist in containers, swingable mounted to mutually connected conveying-carriages, the sidewalls of these carriages themselves forming the chain links and which endless chain conveyor, thus builded, is continuously moved in a closed cycle over an endless track along one or more control apparatus and along the different places of delivery. Thereby during said cycle the documents to be distributed are in succession deposited at any point of the track and on a given moment in an appropriate container and at another point, determined by the setting in the control apparatus and also at a given moment led from said container up to the place of delivery.

According to another object of this invention said arrangement may be such that at every point of transfer in the cycle of the chain conveyor from a circular path into a path according to a straight line a special intermediate bridge-part is provided, the course of it being designed as a complex, connecting curve, which touches the straight line with a radius of curvature of such size, that the transferring curving thus obtained will asymtotically approach the designed theoretical curve from the point of transfer into the straight path.

The described, new construction according to this invention thus assures under all circumstances a regular travel of the endless chain at a speed, increased as much as possible and that independently of the shape, situation or length of the complete track. This gives the important advantage of a very simple and light construction of the whole, whereas also the friction may be reduced to a large degree. Moreover the working of the parts is influenced in a most advantageously way and only a smaller driving capacity will be required. In a sorting and conveying apparatus as mentioned before, moreover the very important feature is obtained, that it will be possible to distribute articles, such as letters, documents or the like, all of different size and weight in exactly the same manner one with another.

It will be evident, that for a good working of the whole apparatus, there must be taken care that also the automatic supply and delivery of the articles to be distributed, shall be in agreement with the higher speed of motion of the endless chain, that is to say, that both actions also take place with certainty without any retardation or acceleration or without any other deviation at the right moment and at the right point. Indeed, in fact of the higher speed of motion of the endless chain, also the documents are to be

deposited in the containers and delivered at the places of delivery at a higher speed.

An object of the invention therefore is to provide said containers with a special flexible receiving-device in order to prevent a bouncing back of the document, being thrown in at that high speed.

Each of the containers, for the documents to be distributed, travelling together with the endless chain-conveyor for that purpose is provided with revolving, segment-like bottomflaps, adapted to be turned in closed position downwardly, when a document is thrown in by means of a level-system, under the action of a spring, thereby completely damping the inertia of said document, whereas after that they are moved back in the original position again by the spring-action.

Each of the flaps forming the container bottom is pivotally connected to a lever, on its turn being pivotable at one end in a point of the side-wall of the container, whereas both levers in the completely inward position of the flaps are pressed by means of a spring, connected to the other end against fixed abutments.

According to another feature of the invention the segment-like part of each of the bottomflaps is formed with such a rounding, that when rotating round the pivot point of the lever, both parts approach each other and grip the document, being thrown in, whereas at a further movement the shafts are adapted to be turned sidewardly, dependent on the thickness of the document.

Finally a further feature of the invention is the special construction of the details, as will be described in the following and as indicated in the annexed claims.

In order to enable the invention in all its details to be readily understood, reference is made to the accompanying drawings which illustrate, more or less diagrammatically and by way of example, the construction according to the present invention.

Fig. 1 shows the construction of the theoretical as well as the approximate course of the intermediate bridge-part in the chain-track;

Fig. 2 is an upper view of the chain-track according to a practical embodiment of the invention;

Fig. 3 shows a diagrammatical sketch of a sorting and conveying apparatus, on which the invention more particularly may suitably be applied;

Figs. 4 and 5 are views partly in section of a container;

Fig. 6 is a diagrammatical upper view of the supply-mechanism for projecting a document or the like into the container, whereas

Fig. 7 shows the same in front view.

Referring to the drawings, 1 (Fig. 1) is a straight part of an endless chain-track, meeting a circular part 2, so that the line 1 is a tangent to the circle 2, drawn with radius R from the centre 3. The chain-links are indicated with the chord "*a*" and in this case the length of said links, only for the sake of a clear apprehension, is made equal to the length of the radius R. Thus so far this system of lines shows the normal and usual course of a track for an endless chain, being moved e. g. in the direction of the arrow. Assuming, that the driving takes place in the circular part and the motion in said part is uniform, in that case at the transfer from the circular path into the path according to a straight line, a retardation and alternatively an acceleration will be caused in the straight part, such, that the motion finally shall take place with shocks; the extent of said retardation and acceleration respectively is proportional to the speed of the chain and the length of the chain-links. In order to obtain also in the straight part of the track the same absolutely uniform motion, according to the invention an intermediate bridge-part is designed between circular and straight path in the following manner:

Starting from the point, in which the retardation is a maximum, that is in the point 4, the point 5 is situated on a distance $=\frac{1}{2}$R from the radius, drawn from the centre 3 and going throught the tangent-point of the circle 2 and the line 1, whereas than the point 4 is given by describing from the point 5 an arc with a radius equal to the length of the chain-link; thus the transferring curve to be designed starts in the point 5. From the point 4 a part is extended, equal to the half-length of the chain-link, in this case $=\frac{1}{2}$R; this gives the point 6. The angle at 3 of the chain-link is bisected and gives the point 7 on the circular path. From this point 7, as well as from the point 6, an arc is described with a radius, equal to the length of the chain-link, viz. in this case =R. The point of intersection 8 of said arcs gives a point of the desired transferring curve. In dividing the length of the link extending from the point 4, as well as the angle at 3 on the circle 2, in equal parts, and in repeating the before mentioned construction for each of the division points, the curve 9 is obtained as the course for the transferring bridge-part, whereby said part assures an absolutely uniform speed on the straight part of the track. The complete course of the track 2, 9, 1 is theoretically exact; for practice however a more simple construction of the part 9 is to be attained. For that purpose a tangent is drawn to the curve 9 parallel to the line 1; from the point 5 again an arc is described with the length of the link so that a point 4*a* is obtained. From this point the same construction, as above described, is repeated, so that a second curve 9*a* is given; this is repeated so many times, until a final curve 10 is found, being a complex of the designed transferring curves and which curve 10 touches the straight part, formed by the tangent 11. As Fig. 1 illustrates, the radius of curvature is such, that the transferring curve 10 finally approaches the designed theoretical curve asymptotically from the point of transfer into the straight path.

Fig. 2 shows a complete track with a number of intermediate bridge-parts, whereas in the same figure also the complete theoretical course is indicated. The difference between the track 10, 11 and the theoretical course 2, 9, 1 gives an approximation, which implies for practice only a deviation that may be neglected.

From the foregoing it will be clear, that with the new construction, a completely uniform motion will be obtained, more particularly also in the case of a great length of the chain-links and at a high speed in the travel. Now the latter is the case with sorting and distributing apparatus for letters, documents or similar articles of the type, as already mentioned in the introduction of this description.

A scheme of such an apparatus is illustrated in Fig. 3, in which 12 is the track for the endless chain; the links 13 of the chain, being moved over said track are formed by the side-walls of the mutually coupled carriages 14 with the swingable containers 15 connected thereto. The carriages are moved along the bottom of control-apparatus 16, whereby the operator deposits the documents to be distributed one after the other and at the

same time makes a setting on the key-board, in order to determine the place of delivery for said document. In consequence of this setting the several parts of the mechanism may come in action, in such way, that at every turn at the projecting of a document or the like, the latter is brought in a desired container 15, whereas said container is swinged out automatically above the inlet of one of a number of chutes 17, guiding the document to the place of delivery, viz. to a given receptacle. To move back again the containers 15 after passing the control-apparatus 16 in the vertical position, contrivances or guide plates 18 are provided.

The Figs. 4 and 5 show the lower part of a container 15; said containers each are formed in the shape of an oblong receptacle, open at upper and lower side, being relatively small in a direction transverse to that of the movement and from which the flat sidewalls 20 courses in the length of the corresponding carriage. The containers are mounted at the upper side of the carriage-frame in such manner, that they are adapted to swing out in both directions. The lower side of the walls 20 is provided with local recesses 21, through which the bottom-halfs are movable for the opening and closing of the discharge mouth of the container. Said bottom-halfs are constructed, as illustrated in the given example, by revolving, segment-like flaps 22, which form, in fully inward-position, as indicated in Fig. 4, a closure of the container, leaving between them at the lowest point a receiving opening for the document deposited therein. The flaps 22 are connected to shafts 24, in lengthwise direction being parallel to the walls 20, each of them at the end having bearings, provided in levers 25, which are pivotable in a journal 26 in a fixed point of said sidewalls 20. The levers 25 are mutually connected by a spiral spring 27 or the like, adapted to normally move said levers in a direction corresponding to the closed position, as indicated in Fig. 4, in which position they are pressed against fixed abutments 28. Outside the point of rotation 24, each of the flaps 22 is formed integrally with a crank 29, at the end of which a rod 30 is hingedly connected. Both rods 30 are on their turn hingedly connected to the sliding bar 31, that on the moment on which the container is arrived on the right place of delivery, is adapted to rotate the shafts 24 in such sense, to open said container and to give an opportunity to the document 32 to be shot with the necessary speed into the corresponding delivery-chute.

By throwing a document 32 in the container, said document as a result of the high speed, impinges against the bottom-flaps in the receiving-opening, whereby these flaps, according to the described construction, are turned downwardly into a position, as indicated in Fig. 5. Said turning of the flaps causes a complete damping of the inertia of the document; after that the flaps move back again to their original position according to Fig. 4, under the action of the spring 27. The result is, that—independent of the weight and the speed of the document—a bouncing back of the latter fully is omitted and said document under all circumstances remains in the right position, ready for being delivered. Furthermore the arrangement is such, that at the delivery out of the container, when being opened, the segment-like parts of the flaps 22 are moved according to a path, as indicated with dotted lines in Fig. 4, whereby they are rotated one towards the other and grip the document. At a further movement both parts approach each other more and more and thereby the shafts 24 are turned more or less outwardly, against the action of the spring 27, dependent on the thickness of the document to be delivered. In that way the latter under all circumstances will be shot outwardly at a high speed into the corresponding delivery-chute.

In the Figs. 6 and 7 the supply-mechanism for the documents or the like is illustrated diagrammatically. Before being deposited in the container, each document is projected by the operator of the key-board at the control-apparatus in a channel 33, closable e. g. by means of a mechanically controlled bottom-valve. As soon as, corresponding with the setting by the operator on the key-board, a carriage with container arrives underneath said channel, the bottom-valve is opened and at the same time the document is gripped between a set of rollers 34 and 35. The roller 34 is continuously driven with a given, relatively high speed, whereas the roller 35 is suspended in swings and is pulled against the roller 34 by means of a lever-system (not shown in the drawings) under the action of a spring. By the rotating of the rollers the document between them is projected with high speed in the container 15, which at that moment is located underneath the channel. The movement of the roller 34 takes place by means of a tooth-gear 36, 37, 38, 39, from the main shaft 40. The toothed wheels 37 and 38 are mounted on an intermediate shaft 41; the wheel 37 is loosely rotatable on said shaft. Between said wheel 37 and the wheel 38, according to the invention, a so-called "slip-coupling" is provided, comprising the coupling-parts 42, 42*a*, from which the part 42 not only is rotatable with the shaft 41, but also slidable thereon. By means of a spiral spring 43, located with one end to an abutment 44, the coupling-part 42 is continuously pressed in the direction of the wheel 37, said wheel thereby being rotated by friction at a normal speed of transmission and being coupled with the shaft. When depositing alternately and at will documents of different thickness and weight respectively, at the transmission of the speed of rotation of the roller 34 on to the document, the initial speed of the latter may be accordingly more or less adjusted automatically and within given limits. Moreover the providing of the slip-coupling has the important advantage, that when by any cause suddenly an abnormal resistance asserts between the set of rollers 34 and 35, the pressure of the spring 43 will be surmounted, the friction removed and the wheel 37 disengaged, now being free to move loosely about the shaft 41. Such an abnormal resistance thus cannot have any unfavourable action on the further transmission and eventually on the working of the other means, controlled by the setting in the control-apparatus.

The performance, as described in the foregoing by way of example, may be altered in details, without leaving the scope of the invention. The invention also can be applied to installations of the type, in which the chain-track not exclusively is situated in a horizontal plane, e. g. to installations for the distributing of letters or the like over a number of rooms, situated on different floors or in which the documents are conveyed in another way than by means of swingable containers.

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PUBLISHED

JULY 13, 1943.

BY A. P. C.

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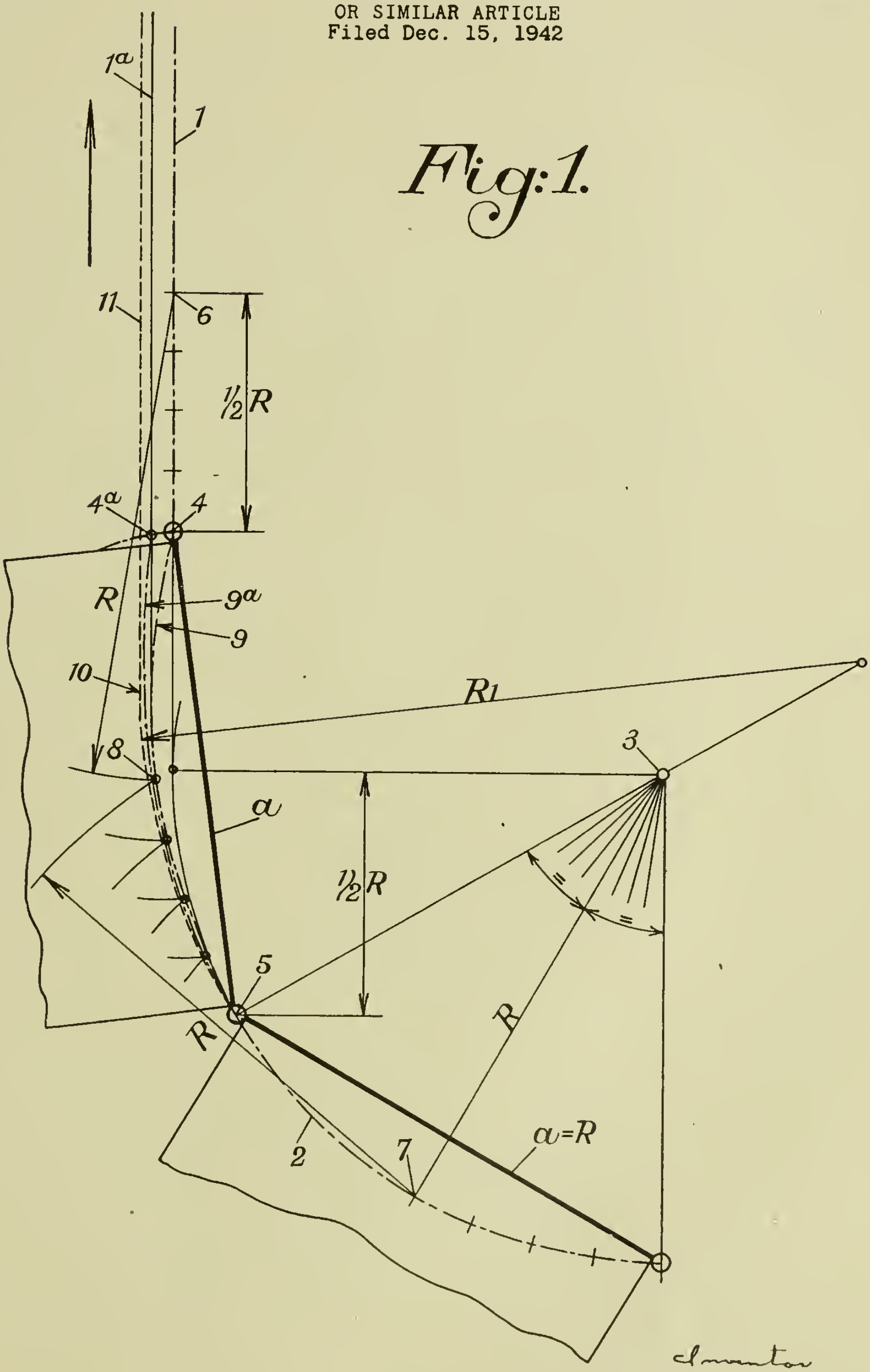
CONVEYING APPARATUS WITH ENDLESS CHAIN MORE PARTICULARLY FOR THE MECHANICAL DISTRIBUTING AND SORTING OF LETTERS, DOCUMENTS OR SIMILAR ARTICLE

Filed Dec. 15, 1942

Serial No. 469,106

3 Sheets-Sheet 1

Fig:1.



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3 Sheets-Sheet 2

Fig:4.

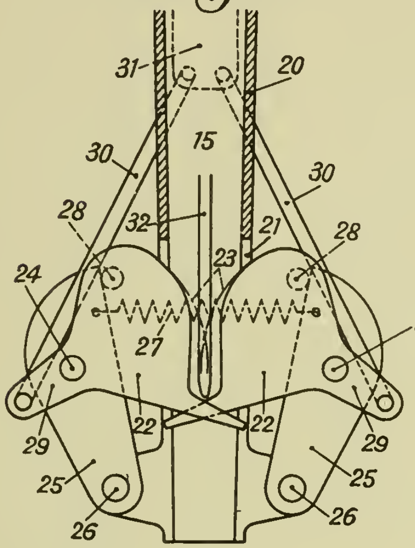


Fig:5.

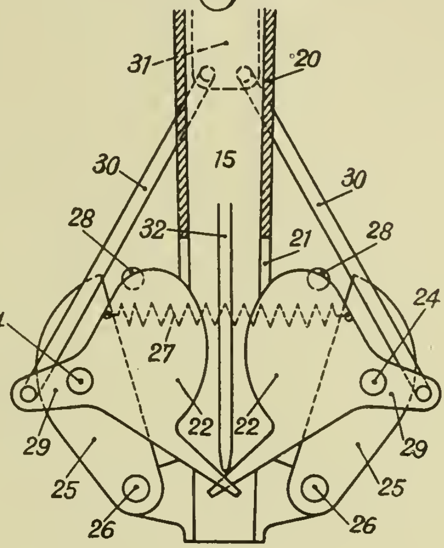


Fig:6.

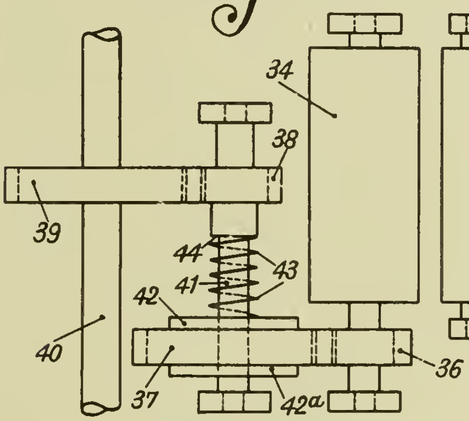
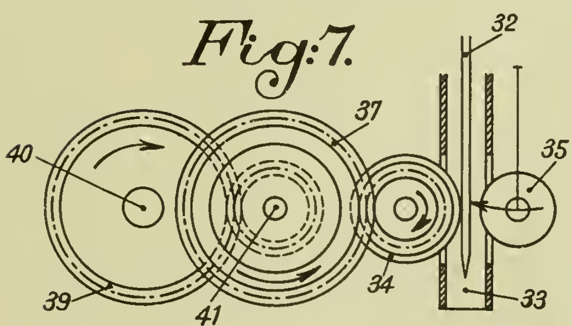


Fig:7.



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3 Sheets-Sheet 3

Fig:3.

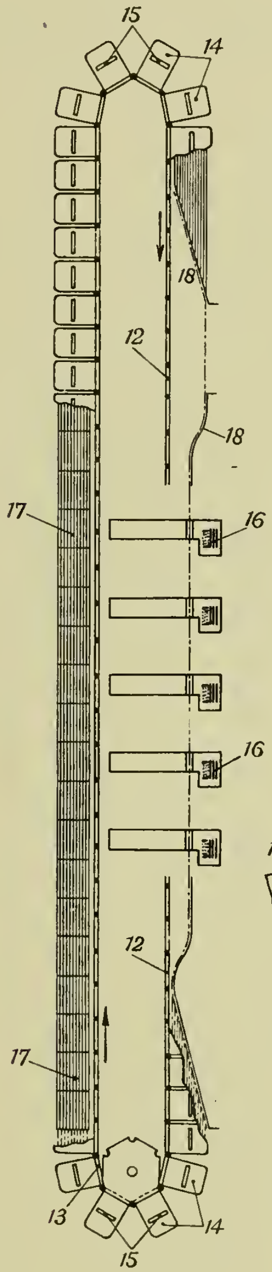
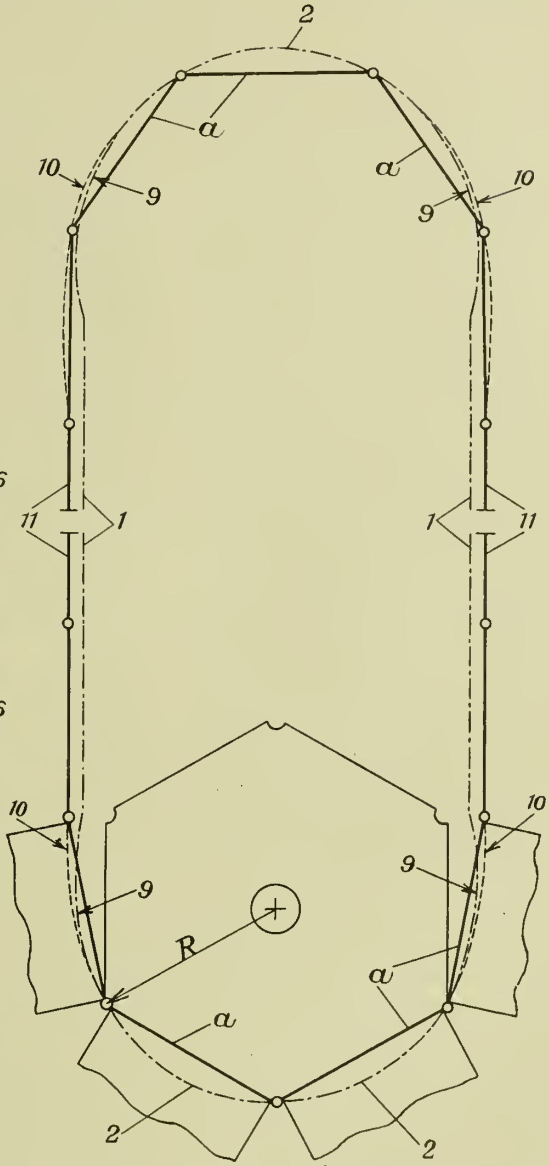


Fig:2.



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ALIEN PROPERTY CUSTODIAN

TELESCOPE SYSTEM

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Application filed December 24, 1942

A spyglass system consisting of a greatly amplifying spyglass and a finder is already known. Spyglasses of this type are first adjusted, with the aid of the finder, on an object to be viewed and thereupon this object or part thereof can be studied with the spyglass of great amplification. As a rule this spyglass system has, however, the drawback, that the finder and the greatly amplifying spyglass are each equipped with a particular ocular so that a user of such a spyglass, upon passing from the finder to the greatly amplifying spyglass, has to change ocular, which involves as a rule that he has also to change his place of observation. In another known form of construction the spyglass system comprises a single ocular, it is true, but upon the passage from the finder to the spyglass of great amplification this ocular has to be re-adjusted, which also entails drawbacks.

The invention has for its object to avoid these drawbacks. The spyglass system of the above mentioned type according to the invention exhibits the feature that with the aid of the spyglass of great amplification and of a few mirrors of which one or more are removable, a detail of the finder image can be represented in the finder with greater amplification than the finder image, the arrangement being such that with the aid of the same ocular both the image of the spyglass of great amplification and the finder image can be observed.

If it is desired to adjust such a spyglass system with the aid of the finder on an object, the removable mirror or mirrors are pushed or tipped away so that the whole or substantially the whole field of view of the finder is at one's disposal. Then the spyglass system is focussed with the aid of the finder. Subsequently, an indicating device which, in accordance with the invention, may be present in the finder and which may consist, for example, of a reticle is adjusted on that detail of the finder image which it is desired to observe with greater amplification than that which is obtained with the aid of the finder. When this is done, the removable mirror or mirrors are brought into the working position and the detail in question can be directly observed through the ocular of the finder in the amplification pertaining to the spyglass of great amplification. To permit sharp observation of this detail it is necessary that the finder image itself and the detail of the image of the spyglass of great amplification which is represented by this spyglass are located at the same place in the finder.

Although spyglasses have in general to satisfy the requirement that the optic angle in which objects can be observed with the aid of such a spyglass should be comparatively large, which requirement causes that on account of the complicated objective or (telescope) mirror such spyglasses are in general rather expensive, a comparatively small field of view and therefore also simple means are sufficient in the spyglass system according to the invention as regards the spyglass of great amplification which occurs therein. This is possible owing to the fact that in the spyglass system according to the invention the finder, which affords a slight amplification in comparison with the spyglass of great amplification, may have nevertheless, by simple means, a large field of view, owing to which the spyglass system according to the invention may also be of considerably cheaper construction than the customary spyglasses of great amplification. Although it is possible to construct the spyglass of great amplification which is present in the spyglass system according to the invention as a refractor spyglass, it is advisable, in accordance with the invention, to constitute this spyglass by a telescope since the latter can be realised by simpler means than a refractor spyglass.

The mirrors which represent the image of the spyglass of great amplification in the finder may be separate mirrors. It is, however, also imagible to constitute one or more of these mirrors by one or more totally reflecting boundary surfaces of one or more prisms. It is, however, of great importance that the removable mirror system, which may consequently consist of one or more mirrors, should be very small and light. In one form of construction of the spyglass according to the invention the removable mirror with the appurtenant mounting has a weight of only 0.3 g. If the removable mirror system is satisfactorily supported in mechanical respect, which may be realised by simple means, we obtain the advantage that the image of the spyglass of great amplification can be moved into and out of the finder by means of this removable mirror system with an extremely slight exertion. This is of great importance since now there is no risk of this movement bringing about a movement or vibration of the entire spyglass system, which might lead to the adjustment on a determined object being destroyed due to such a movement or vibration. The mirror system may be removed, for example, by exerting an extremely slight pressure on the controlling wire of a Bowden cable system.

With the spyglass system according to the invention the distance of the object is in general so large and, if the spyglass of great amplification is constructed as a telescope, the mirror present therein may be constructed so as to have so small a diameter that means for neutralizing the spherical aberration which occurs with such a mirror if the latter has a spherical shape, are not absolutely necessary. According to the invention, however, it is preferred more particularly if use is made of telescope mirrors of large diameter, to arrange at some distance from the telescope mirror a correction element which neutralizes, either wholly or partly, the spherical aberration of the telescope mirror. If desired, this correction element may be built up from more than one lens.

The spherical aberration can be neutralized practically completely by a correction element whose surface has, at least on one side, the course of a curve higher than one of the second degree. These elements may be made of glass; on account to the complicated shape of these surfaces, it is desirable, however, to constitute them by a transparent material which, or at least the starting material of which, at a low temperature and, as the case may be, in solution, can be deformed, more particularly gelatinized, pressed, press-cast, squirted or die-cast. Over a glass correction element of the same shape a correction element consisting of such materials offers the advantage that without any need of being ground it can be manufactured with great precision in a template. When the template has once been made, for example from metal, on a lathe it is possible to produce with the aid of such a template a practically unlimited number of correction elements.

On the other hand, it is also possible, according to the invention, to form the correction element with spherical boundary surfaces, if desired, combined with plane boundary surfaces. Correction elements of this kind offer the advantage that they are very cheap and may consist of ordinary commercially obtainable spectacle-glasses. It is also possible to obtain the telescope mirror by forming a spherical meniscus lens on one side as a mirror, in which event also a spyglass with satisfactory properties can be obtained by very simple and little expensive means.

The limitation to a small field of view involves the advantage that in this case the above-mentioned correction element may be arranged, without causing excessive divergences, at a distance from the telescope mirror which is approximately equal to the focal distance of this mirror. This arrangement has the advantage that the same correction element functions properly for any distance of the object which may occur in practice.

The arrangement at a distance approximately equal to the focal distance of the telescope mirror affords the advantage that the constructional length of the spyglass becomes comparatively small so that the latter can be easily handled.

According to the invention, it is simple from a constructional point of view to construct the spyglass system, if in the latter a telescope is utilized as the spyglass of great amplification, in such manner that the plane of the finder objective and the plane of the correction element coincide or at least substantially coincide and/or that the plane of the telescope mirror and the plane of the ocular also coincide or at least substantially coincide.

The invention will be explained more fully with reference to the accompanying drawing wherein

Fig. 1 represents a diagrammatical longitudinal section of one embodiment of the spyglass system according to the invention, wherein the spyglass of great amplification is constructed as a telescope.

In this figure **1** and **2** denote a telescope and a finder respectively which both comprise cylindrical casings **3** and **4** respectively which are rigidly secured relatively to one another with the aid of clamps **5**. At **6** and **7** the walls of the telescope casing and of the finder casing have apertures which are in alignment with each other. To the finder casing **4** is secured a jointed ball and socket coupling **8** which permits the adjustment of the whole spyglass with respect to a stand (not shown).

The telescope mirror **9** consists of a spectacle glass **9** whose concave surface **10** is silver-plated. The mirror thus obtained has a focal distance of 50 cms. This focal distance is approximately equal to the distance between the mirror **10** and the lens **11** which eliminates or at least substantially eliminates, the spherical aberration of the mirror **10**. The lens **11** is a meniscus lens of a power of —0.25 dioptric. The lens **11** has spherical surfaces.

In the finder is arranged an objective **13**, likewise a biconvex lens with spherical surfaces, which has its focus at F_{13}. In the finder are arranged furthermore an amplifying inverting lens **14** and an ocular which consists of two lenses **15** and **16**. Furthermore, in the telescope is arranged a plane mirror **17**, in the apertures **6** and **7** of the telescope casing and the finder casing respectively a plane mirror **18** and in the finder a plane mirror **19**. These mirrors are arranged with respect to one another in such manner that at F_{13} an image is formed of an object present at a large distance from the telescope. All this follows from the path of the represented light rays *a* and *b*.

The mirror **19** is arranged on the end of a Bowden cable mechanism **20** (Fig. 2) so that upon depressing a button **21** provided thereon this mirror **19** occupies the position shown in Figs. 1 and 2 (working position). When the button **21** is released, the mirror **19** returns, under the action of a spring (not shown), to its position of rest (indicated in dotted lines in Fig. 2) outside the rays of light *c* and *d* which form the finder image. The Bowden cable mechanism is fixed in the casing **4** of the finder with the aid of a bush **22**. The mirror with the appurtenant mounting has a weight of only 0.3 g. If the mirror **19** is out of reach of the light rays *c* and *d* it is possible to focus an object in the spyglass by means of the finder with the aid of the objective **13** present therein, the inverting lens **14** and the ocular **15—16**. When the object has once been focussed, for which purpose the holder **24** of the ocular lenses may be caused to slide to and fro in the finder casing, the reticle system **23** is aimed at that part of the object which it is desired to observe with greater amplification. Subsequently, by pressing the button **21** of the Bowden cable mechanism the mirror **19** is placed in the working position indicated in Fig. 1. It is now possible to observe the desired detail directly through the ocular in the amplification of the telescope.

According to the size of the mirror **19** the telescope image in the finder overlaps the finder image proper either wholly or partly. Thus, Fig.

3 shows an example wherein the field of the finder and that of the telescope in the finder are denoted by **25** and **26** respectively, the reticle system being denoted by **23**. It may be seen from the figure that out of the finder image, which consists here of a church and a house, a portion, viz. the church-clock, is represented greatly amplified in the telescope and partly overlaps the finder image. In the form of construction according to Fig. 1, on the contrary, the telescope image is larger than the finder image, which ensues from the fact that the mirror **19** intercepts the outermost light rays *c* and *d* which come from the left from the finder objective so that to the right of the mirror **19** these rays of light are therefore represented in this figure in dotted lines.

Owing to the use of the mirrors **17**, **18** and **19** it is possible to obtain a spyglass whose dimensions remain within reasonable limits. Furthermore, the use of the mirror **10** with a comparatively large focal distance renders it possible to utilize a correction element of simple shape. The lens **14** ensures a further amplification of the telescope image.

Even if the spyglass of great amplification is a refractor spyglass, the spyglass system may, of course, also be constructed, if desired, as a double spyglass.

ALBERT BOUWERS.

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BY A. P. C.

A. BOUWERS
TELESCOPE SYSTEM
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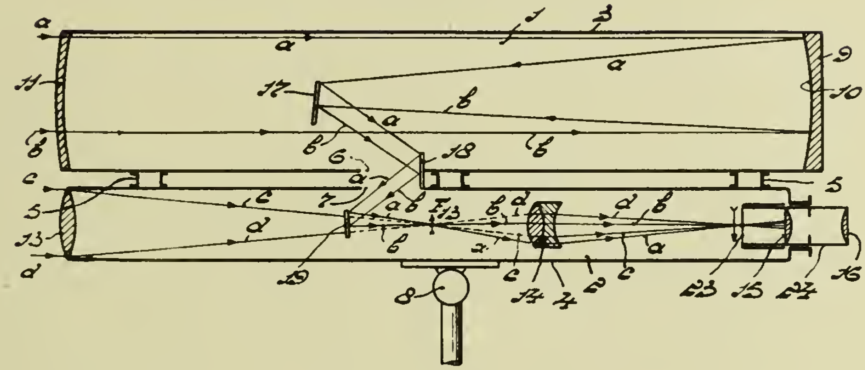
Fig. 1



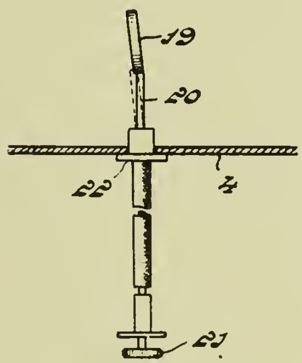


Fig. 2

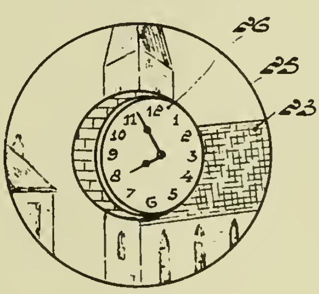


Fig. 3

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ALIEN PROPERTY CUSTODIAN

FOUNTAIN PEN

Max Leeuwin, Eindhoven, Holland, vested in the Alien Property Custodian

Application filed December 24, 1942

This invention relates to a fountain pen whose supply of ink contained in the holder is visible from without.

In such well-known fountain pens the holder is made from a material which is entirely or partially transparent. The supply of ink is contained in the holder constituting the ink barrel. This fountain pen has the drawback of the ink continually engaging the transparent wall due to which an opaque coating eventually deposits on this wall. Thus the transparency of the ink holder highly decreases in the long run so that the holder no longer suits the purpose.

The present invention purports to provide a fountain pen having a visual supply of ink and the transparency of whose holder remains unchanged even after using it for a long time.

The fountain pen according to the invention is characterized by the combination of a holder of transparent material containing a separate interchangeable ink cartridge which is also made from transparent material.

In this case direct engagement between the ink and the transparent wall of the holder does not take place so that fouling is prevented. After exhaustion of the supply of ink the transparent ink cartridge is replaced so that the wall of the ink cartridge is always clean.

It is known per se to furnish fountain pens with a separate interchangeable ink cartridge. These ink cartridges are made from transparent material such as glass, but the wall of the well-known fountain pens equipped with such a cartridge does not consist of transparent material.

The invention will be more fully explained by reference to the accompanying drawing given by way of example.

In the sole figure the reference number **1** designates the pen head to which is secured the writing pen **2**. The holder **3** consists of transparent material, for instance a transparent variety of artificial resin, and is screwed to the pen head **1** in the conventional way. The holder contains a glass cartridge **6** which is filled with writing ink. This cartridge has a conical tapering end **7** which engages a ring **5** secured to the pen head, thus obtaining the obturation between ink cartridge and pen. Upon introduction of the cartridge the ink conductor **4** destroys the closure in the tapered part **7** and establishes a connection with the writing pen **2**.

Consequently the ink is exclusively in the holder **6** and within the annular closure **5**. The space between the cartridge **6** and the holder **3** is always free from ink so that the material of the wall **3** always remains transparent. After exhaustion of the supply of ink the glass cartridge **6** is replaced so that also the wall of this cartridge is always clean. Hence the supply of ink is always visible.

For aesthetical reasons the outer wall **10** of the holder **3** is frequently corrugated. Yet in order to permit observation of the surface of the ink contained in the ink cartridge the holder is provided throughout its length with at least one smooth strip **9** which extends in a longitudinal direction and serves as a gauge. There are preferably two of such strips which are obtained by smooth finishing of the moulding seams formed in manufacturing the holder **3**. These smooth strips may also be used for providing the trade mark, manufacture numeral or the like.

The holder is made from a material having a high resistance to rupture which, moreover, permits a large number of uniform articles to be moulded in a cheap manner. To such end use may be made of a transparent variety of artificial resin.

MAX LEEUWIN.

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M. LEEUWIN
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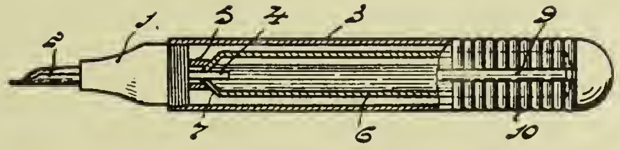

INVENTOR
Max Leeuwin
BY A. F. Wenderoth
ATTORNEY

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR MEASURING LOW DIRECT VOLTAGES

Cornelis Dorsman, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed December 24, 1942

For measuring direct-current voltages of slight value and, more particularly, for measuring the terminal voltage of a source of direct current of very high internal resistance there are known devices with which the direct-current voltage to be measured is converted into an alternating voltage by means of a condenser which is charged by the direct-current voltage to be measured whilst means are provided with the aid of which the condenser capacity is periodically altered with a determined frequency. From the condenser may be taken in this case an alternating voltage whose amplitude is proportional to the value of the direct-current voltage supplied thereto and which, after being amplified and, as the case may be, after being rectified, can be measured in a simple manner. Such devices may also be advantageously utilized in determining the value of direct-current voltages with the aid of a compensation method, in which event the accuracy attained depends on the accuracy with which the difference in value between the unknown direct-current voltage and the known direct-current voltage can be measured.

The applicant has found that the accuracy with which a direct-current voltage can be measured with the aid of the above-described devices is under certain conditions considerably smaller than might be expected in view of the amplifier utilized for the amplification of the alternating voltage taken from the condenser.

The invention has for its object to provide means which ensure, with devices of the above-described type, a considerably greater accuracy of measurement.

The invention is based on the recognition that the accuracy of measurement may be harmfully influenced by the source of supply of the amplifier employed if this source of supply furnishes a supply voltage which contains at least an alternating voltage component and that the said harmful influence occurs even then if the supply voltages obtained, as the case may be, by rectification and supplied to the amplifying tubes of the amplifier (anode- and screen grid voltages, control grid bias voltages and the like) are carefully smoothed.

According to the invention, the said drawback, which is apparently due to capacitative and/or inductive coupling between, on the one hand, the mains conductors present in the space in which the measuring device is arranged and, on the other hand, the condenser of periodically varying capacity, its connecting conductors to the amplifier and to the source which furnishes the direct-current voltage to be measured and conductors or objects connected to the said source, is avoided by ensuring that the variation frequency of the condenser differs from the frequency of the said alternating voltage component and of those higher harmonics of this frequency which may give rise to a disturbing alternating voltage component in the amplifier whilst the alternating voltages of different frequencies which are taken from the condenser are separated according to frequency in such manner that of these alternating voltages only those whose frequency corresponds to the variation frequency of the condenser, bring about an indication.

In order to simplify the separation according to frequency of the alternating voltages taken from the condenser, if the variation frequency of the latter is comparatively low, for example, less than 200 c. p. s. the variation frequency is preferably so chosen as to be, at least approximately, equal to $(a+\frac{1}{2})n$ if n is the frequency of the alternating voltage component of the supply voltage and if a is an integer.

The separation of the alternating voltages according to frequency may be effected by the indicating instrument itself which is connected to the amplifier by utilizing as such an indicating instrument known in itself which is only responsive to a determined frequency.

It is, however, advisable to utilize an amplifier which selectively amplifies the variation frequency of the condenser, owing to which it is rendered possible to employ a responsive indicating instrument of common type, for example, a moving coil instrument or a cathode-ray indicator.

The invention will be explained more fully with reference to the accompanying drawing which represents, by way of example, one favourable embodiment ethereof.

With the device according to the figure the direct-current voltage to be measured consists of the difference between a voltage of unknown value E_{pH}, as is the case, for example, in determining concentrations of acid (measurements of pH) and an adjustable comparison voltage E_v of known value. The difference of voltage prevailing across the connecting terminals 1 of the device according to the invention is supplied to the series connection of an ohmic resistance 2, preferably of high value, and a condenser 3, with the result that the condenser is charged by the voltage to be measured. By altering the value of the condenser periodically with a determined frequency, there is set up across the connecting ter-

minals of the condenser an alternating voltage whose value is proportional to the value of the direct-current voltage supplied to the condenser. In the device shown the alternating voltage thus obtained is supplied, with the aid of coupling condensers 4, 5, to the control grid of an amplifying tube 6 and, after being further amplified with the aid of a second amplifying tube 7, to the control grid of a triode amplifying system which is provided, jointly with a cathode ray indicator, in a tube 8, the said indicator acting in the present instance as the indicating instrument. The circuit arrangement is so chosen that if no alternating voltages occur at the condenser 3 and if, consequently, E_{pH} and E_v are equal, the fluorescent surface of the cathode-ray indicator has a minimum and constant size whereas, if the said voltages have different values and if, consequently, there occurs at the condenser 3 an alternating voltage whose value is proportional to the difference voltage, the fluorescent surface is larger than in the first-mentioned case and, besides, varies in the rhythm of the alternating voltage.

The amplifier is constructed for being supplied from alternating current mains. The alternating voltage taken from the mains is supplied to the connecting terminals 9 of the primary winding of a main transformer 10 and, after being rectified by a full-wave rectifying tube 11 and after being smoothed with the aid of a smoothing filter constituted by two condensers 12 and a series-resistance 13, to the amplifying tubes 6, 7 and 8.

Since amplifying systems and supply systems of the type shown in the figure may be assumed to be known and since the precise construction thereof is not essential for the present invention, they will not be described here in detail.

As previously mentioned, the invention has for its object to prevent alternating voltages which originates from the power network and which, due to capacitative and/or inductive coupling between the power network and the condenser 3 with the conductors and devices connected thereto, produce similar alternating voltages across the connecting terminals of the condenser 3, from having a disturbing influence on the measurements to be taken.

The frequencies of the disturbing voltages which may occur due to the said coupling, correspond of course to the mains frequency and/or to higher harmonics thereof; it should be considered in this connection that some higher harmonics of the mains frequency or, in the case of direct-current mains, higher harmonics of the fundamental frequency of the alternating voltage component of the mains voltage, frequently have a comparatively large amplitude. The disturbances thus produced would give rise to the impossibility of stating exactly when the alternating voltage set up by the voltage to be measured is equal to zero since, independently thereof, there always occurs at the condenser an alternating voltage. According to the invention, such a disturbing influence is avoided by choosing the variation frequency of the capacity of the condenser 3 in such manner that it differs from the mains frequency and from those higher harmonics thereof which might give rise to disturbances whilst those alternating voltages taken from the condenser which have a frequency which corresponds to the variation frequency of the condenser capacity are only supplied to the indicating instrument after being selectively amplified.

To that end the device shown comprises a tube generator 14 in a circuit arrangement which is known in itself. This generator is supplied by the mains supply device provided for the amplifier and generates oscillations whose frequency is determined by an oscillatory circuit 15. The oscillations set up in this circuit are supplied, with the aid of a transformer 16, to a coil 17 which is movably arranged in a magnetic field produced by a permanent magnet 18. For the coil 17 and the magnet 18 may advantageously be employed any loudspeaker system known in itself. As is diagrammatically indicated in the figure, the coil 17 is mechanically connected to one of the electrodes of the condenser 3 in such manner that the electrodes are set into relative vibration and thus the capacity of the condenser is altered in the rhythm of the oscillations produced by the generator 14. A direct-current voltage supplied to the condenser 3 is converted in this case into an alternating voltage whose frequency corresponds to the natural frequency of the circuit 15. This alternating voltage is selectively amplified with the aid of the amplifier 6, 7, 8 since the anode impedance of the tube 6 consists of an oscillatory circuit 19 tuned to the variation frequency of the condenser 3. At a proper choice of the variation frequency it will in general be possible to obtain a sufficient selection even with the aid of a single oscillatory circuit of satisfactory quality. In view thereof the variation frequency is preferably so chosen as to correspond to $(a+\frac{1}{2})n$ if n is the mains frequency or, in the case of direct-current mains, the fundamental frequency of the alternating voltage component of the mains voltage and if a is an integer and preferably larger than unity. If, for example, $n=50$ c. p. s. the variation frequency preferably amounts, for example, to 125 c. p. s.

Owing to the said steps it is ensured that any disturbing voltages occurring at the condenser 3 and originating from the supply mains have no influence on the indicating instrument and that thus a very high degree of accuracy is guaranteed.

CORNELIS DORSMAN.

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C. DORSMAN
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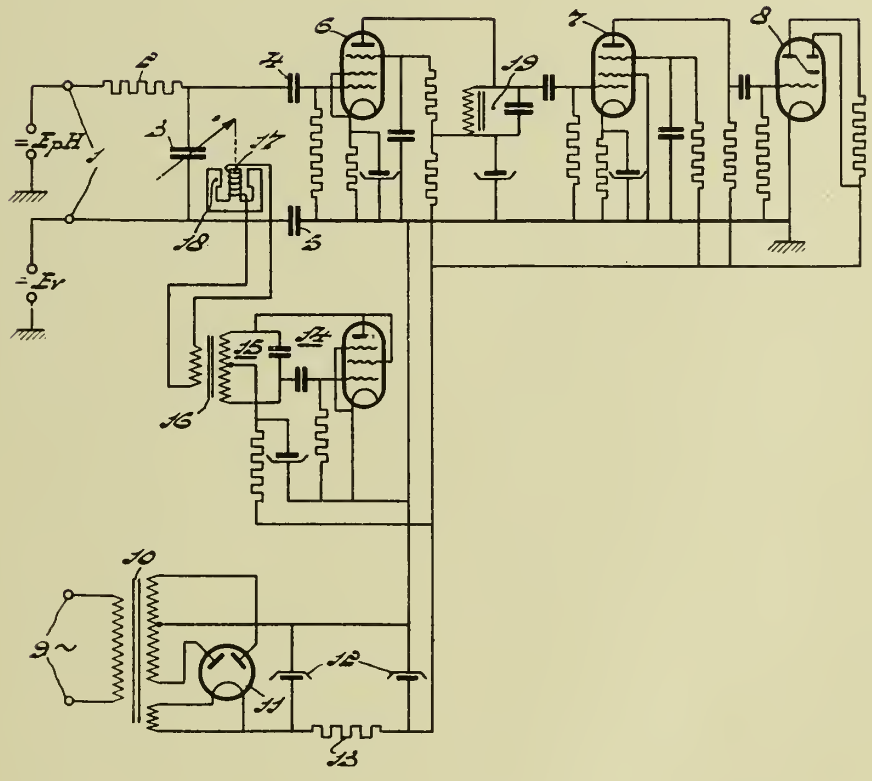

INVENTOR
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ATTORNEY

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR MEASURING DIRECT VOLTAGES

Pieter Adriaan Donker, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed December 24, 1942

For measuring direct voltages of low value and more particularly for measuring the terminal voltage of a source of direct current having a very high internal resistance it is known to use devices in which the direct voltage to be measured is converted into an alternating voltage by means of a condenser which is charged by the direct voltage to be measured, provision being made for means whereby the condenser capacity is changed periodically at a given frequency. This permits of obtaining from the condenser an alternating voltage whose amplitude is proportioned to the value of the direct voltage supplied thereto, it being possible for said alternating voltage to be measured in a simple manner after being amplified and in some cases, rectified. Devices of this kind may be used with particular advantage for ascertaining a difference voltage obtained by means of a compensating method, as is, for example, essentially the case when adjusting the equilibrium of a bridge circuit supplied with direct current in which the difference of the voltage occurring across two adjoining bridge circuit branches should be reduced to zero. In this case, the bridge circuit may be used for ascertaining the value of ohmic resistances.

However, the well-known devices hereinbefore described for converting direct voltage into alternating voltage have the disadvantage of being comparatively involved and costly since a variable condenser of special construction should be used.

According to the invention, the said disadvantage is obviated by effecting the conversion of the direct voltage to be measured into an alternating voltage by supplying the latter to the series combination of a resistance and a condenser, the condenser being short-circuited periodically at a given frequency. In this case, the alternating voltage can be obtained from the condenser itself or from the resistance connected in series therewith and after amplification its value may be ascertained by means of an indicating instrument of standard type. Preferably, the resistance connected in series with the condenser has a comparatively high value, for example 10 megohms, so that the source of voltage whose terminal voltage is to be ascertained, may be loaded as little as possible.

For attaining a maximum amplitude of the alternating voltage obtained it is favourable to choose the device such that the condenser periodically discharges practically entirely and this may be reached by a suitable choice of the time over which the condenser is short-circuited and of the time constant of the discharge circuit of the condenser.

In addition, unless a feeble load of the source of voltage whose terminal voltage is to be measured is required, the time constant of the condenser-charging circuit may be such that at the end of the charging period the voltage at the condenser is but little lower than the direct voltage to be measured.

If, the direct voltage converted into alternating voltage is obtained from the condenser the device according to the invention may be simplified by constituting the condenser connected in series with the resistance by the capacity between control grid and cathode of the input amplifier valve of the amplifier.

In order that the invention may be clearly understood and readily carried into effect one convenient form of construction of the device according to the invention is diagrammatically shown in the accompanying drawing.

Referring to the single figure, **1** designates the input terminals of a device which has supplied to it the direct voltage to be measured which, by means of the part **2** shown within dotted lines is converted into an alternating voltage which after amplification by means of an amplifier valve **3**, is supplied to the control grid of a triode-amplifier system which, jointly with a cathode-ray indicator, is housed in a tube **4**. In the device shown, the cathode-ray indicator serves as an indicating instrument but obviously another indicating instrument, for example a rotary coil instrument, may be used.

Since amplifier arrangements of the type shown in the figure may be assumed to be known and their accurate construction is not essential for the present invention further details will not be entered into.

The conversion of the direct input-voltage into alternating voltage is effected by supplying it to the series combination of a resistance **5** and a condenser **6**, the latter being shunted by a contact **7** which is closed periodically. For this latter purpose, one of the contact points of the contact **7** is fixed to a spring **8** which is set vibrating by means of a coil **9** supplied with alternating current from the power-supply circuit.

It is obvious that the periodical short-circuiting of the condenser **6** can also be brought about otherwise, for example by means of a rotary contact device, but the construction shown is generally to be preferred on account of its particular simplicity.

During the time the short-circuit contact 7 is open, the condenser 6 will be charged, upon the supply of a direct voltage to the input terminals 1, to a voltage which is higher as the direct voltage supplied is higher, there being a linear proportionality between the value of the direct voltage supplied and the maximum instantaneous value of the voltage at the condenser. The closure of the contact 7 has the effect of discharging the condenser, and if the resistance in the discharge circuit is very low, as in the case of the device illustrated, the condenser is discharged practically entirely, this being advantageous, as already mentioned, for the purpose of obtaining a large amplitude of the alternating voltage occurring at the condenser.

In order to prevent the discharge time of the condenser from being influenced by reason of an alteration of the contact resistance of the contact 7, as may be harmful in undertaking accurate measures, a resistance of suitable value may be included in the discharge circuit.

The alternating voltage occurring at the condenser 6 is supplied to the control grid of the amplifier valve 3. As already observed it is possible to use the control grid-cathode-capacity 4 shown in dotted lines in the figure instead of the condenser 6 for the conversion of the direct voltage into an alternating voltage, this being particularly convenient if the internal resistance of the source of voltage whose terminal voltage is to be measured is high.

When undertaking measures for which great sensitiveness of the measuring device is required, as is the case for example when adjusting the equilibrium of a bridge circuit by means of the device shown in the figure, the time constant of the charging circuit of the condenser 6, or the condenser 10 respectively, may be chosen with advantage to be smaller than the time over which the contact 7 is open, the discharge time of the condenser being preferably chosen to be about equally as large as its charging time. As is self-explanatory, a symmetric alternating voltage and hence on either side of the bridge equilibrium an equally large and equally light intense indication on the cathode-ray indicator, is thus obtained. In order that the device illustrated may be readily altered to accord with the object for which it is to be used, the resistance 5 for example may be made variable and/or the condenser 6 may be rendered capable of being cut out of circuit, or of being replaced by a condenser of different value respectively. When measuring a direct voltage having an alternating voltage superimposed upon it, as is the case for example if the bridge is supplied by means of a rectifier, it is possible in the use of the circuit arrangement according to the invention to connect in series with advantage a simple smoothing filter so as to permit of the bridge equilibrium being better observed.

It may be observed that if the terminal voltage of a source of current having a very high internal resistance is to be ascertained, the resistance 5 in the circuit arrangement shown may be very small under certain conditions and in such case the condenser 6 should also have a lower value.

PIETER ADRIAAN DONKER.

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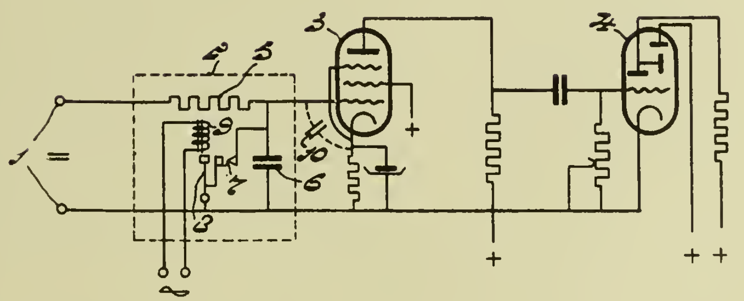

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR FEEDING MACHINES FOR PACKING TUBULAR PRODUCTS

Gerard Bardet, Paris, France; vested in the Alien Property Custodian

Application filed December 30, 1942

Certain machines, like those for packing cigarettes, macaroni, etc., require that the products to be packed should be fed to them in a given order, according to a certain cadence and in definite quantities.

The systems using simple travelling bands and the like do not allow, in general, to obtain the result sought for, in particular because the suitable grouping of the products cannot be effected without difficulties or with the different presentations required by the various packet structures, especially when important outputs are to be attained.

The present invention has for object a device ensuring the rapid and sure feeding of the packing machine, mainly consisting in a distributing chain carrying feeders in which the tubular products are poured in the desired quantity.

The tubular products to be packed are led from the magazine on bands between which moves the chain carrying the feeders which are filled one by one with the products conveyed by the bands and lead them in proximity to the packing device.

A preferred embodiment of the subject-matter of the invention will now be described in detail with reference to the accompanying drawing in which:

Fig. 1 is a view in vertical section of the device.

Fig. 2 is a plan view.

Fig. 3 is a section made according to line III—III of Fig. 1.

The tubular products, for instance cigarettes, are housed in a magazine 2 the bottom of which is constituted by two endless bands 3, 4, spaced apart; an interval is provided between said bands and the front edge 5 of the magazine. A vertical wall 16 extends throughout the length of the device and constitutes one of the sides of the magazine 2, the other side of the magazine remaining open.

Beneath the bands 3, 4 is arranged an endless chain or apron 6 carried by two pulleys 7, 8 one at least of which, 7, is a driving pulley and connected by a transmission 9 to the shaft 10 controlling the shaft 11 driving the pulleys 19, 20 over which pass the bands 3, 4.

On said chain or apron 6, are placed side by side feeders 12 each constituted by the assemblage, on a base 14, of four identical sheet metal plates 13 arranged in such a manner as to form three chambers 15.

The operation of the device is as follows:

When the apron 6 is set in motion, the bands 3, 4 move in the direction of the arrow F and deliver the products 1 which fall into the chambers 15 in proportion as the feeders 12 engage between the bands 3, 4, and, owing to the inclination of the chain 6, emerge above the bands.

The products 1 fill the chambers 15; and the feeders thus filled continue to advance until they come in proximity to the packing machine (not shown) towards which a hand 16 guides them by ejecting them from the chambers 15 (as indicated in dotted lines in Fig. 2).

A simple or compound scraper or similar device 17, allows of removing from the feeders 12 any unforeseen overload. According to an arrangement illustrated in the drawing for packing cigarettes, a push-piece 18 the suitable operation of which is ensured by the action of inclines on its tail-member, is engaged in the central chamber of each feeder 12. It rises first of all to the value of one cigarette when the feeders are filled up, on the up side of the scrapers 17; the push-piece then falls back again before the feeder comes in front of the hand 16. In this manner the loading of the lateral chambers is each of seven cigarettes and that of the central chamber of six cigarettes, each chamber being slightly offset relatively to the central chamber. Moreover, by the same process, other asymmetries can be obtained in the filling of the chambers.

It is to be understood that the invention is not limited to this arrangement of the feeders and of the conveyor chain.

It is thus that, in particular for light products, a compacting of the latter is obtained, by arranging along the chain any vibratory mechanism.

Although the chain 6 is, substantially, inclined relatively to the horizontal, this compelling the products which have been unable to find a place in the chambers 15 to redescend towards the mass of those which are constantly drawn along by the bands 3, 4, it is important to notice that, even with a chain which is not inclined or only slightly so, the bands 3, 4 accompany the products beyond the moment when they encounter the chambers and up to the bottom of the latter, and that they are thus arranged in order without shocks and without interruption, which allows of avoiding the deterioration of the products and the possibilities of their becoming wedged.

The chambers can be of various shape and arrangements, according to the nature of the product to be packed; of course, their number can be varied as well as the way in which they are pivoted on the chain or apron, and the methods for driving the chain and the bands.

Finally, the ratio between these two movements can, by means of a speed varying device of known type, be adjusted at every instant to the optimum value which is suited to the product to be distributed according as it is necessary, for the satisfactory operation of the distributor, to accelerate or to slow down the flow of products towards the scrapers 17.

GÉRARD BARDET.

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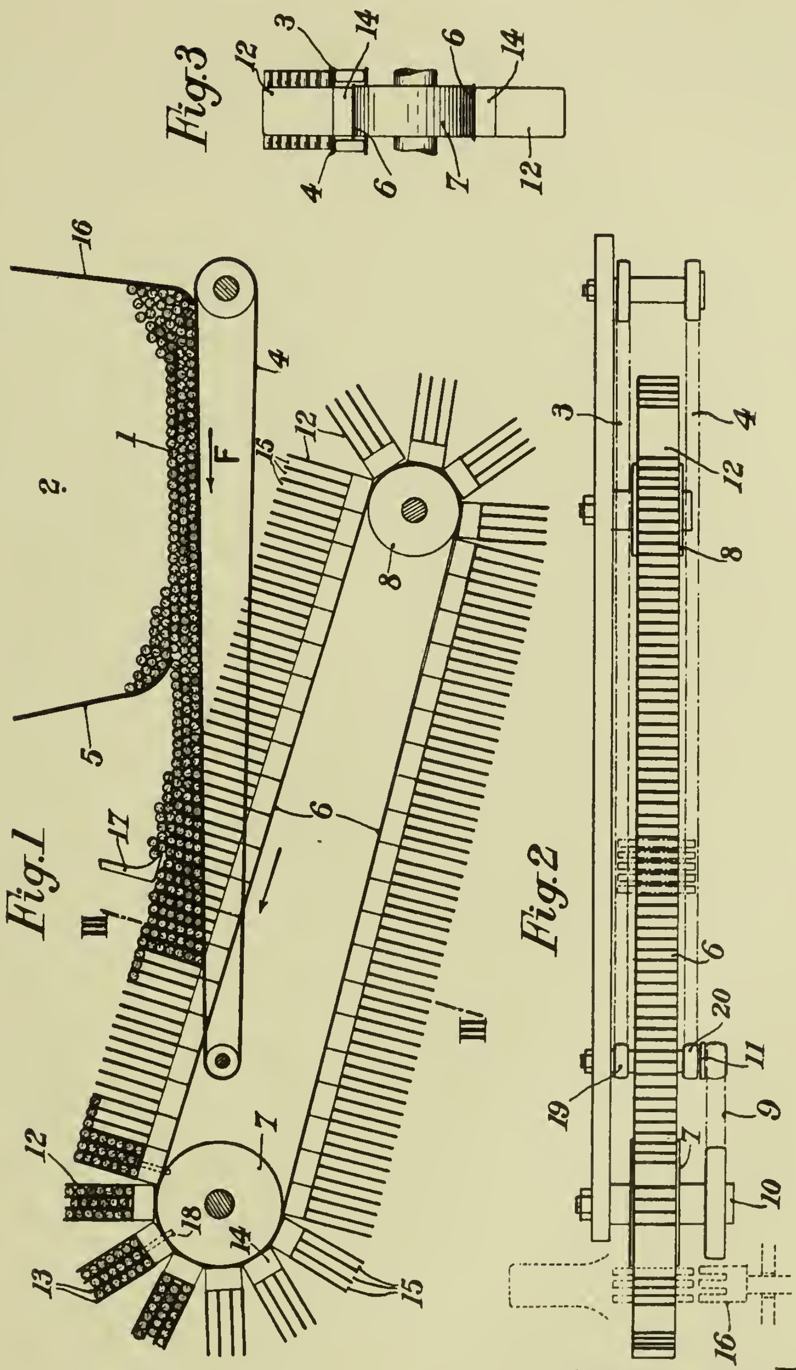

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR HOT ROLLING VERY LONG THIN STRIPS

Paul Blain, Paris, France; vested in the Alien Property Custodian

Application filed December 30, 1942

When hot rolling very long thin strips the inconvenience is encountered consisting in the rapid cooling of the metal in course of rolling, cooling which is due, in particular, to the intense radiation of the surface of the strip which, for a given weight of the blank, increases very rapidly when the thickness diminishes.

According to a known process the cooling of the strip in course of rolling is slackened by storing the latter in furnaces placed on either side of the reversible rolling-mill serving for rolling the strips, instead of allowing it to develop freely on the lines of cylinders or on the tiles of the workshop. The strip is wound according to this process on drums placed in the furnaces in question; said drums are themselves heated by the furnace and are actuated by an electric control which effects the required synchronism between the drums and the rolling-mill.

The present invention has for object a process according to which the strip is wound without the aid of drums during rolling, by means of bending-winding machines, preferably placed on either side of the housing of the rolling-mill and in the immediate vicinity thereof, the strip winding up in one of the machines in question while it unwinds from the other. The cooling of the strip is therefore slackened, according to this process, solely by the effect of the reduction of the radiating surface of the blank in course of rolling.

The control for the bending-winding machines is preferably devised in such a manner that the machine which winds the strip has a peripheral speed slightly greater than the speed of the strip issuing from the rolling-mill; said machine thus exerts a pull on the rolled strip, whereas the machine which unwinds the strip has a peripheral speed equal to the speed of the strip when it enters the rolling-mill and exerts on the latter a braking stress.

This result is very simply obtained, for instance by actuating the machine which winds the strip, from the control of the rolling-mill itself by means of gears or through the medium of a chain transmission imparting the required ratio between the number of revolutions of the cylinders of the rolling-mill and of the cylinders of the bending-winding machine, and by allowing the machine unwinding the strip to be set in action by the stress exerted on its cylinders by the strip itself.

Of course, the controls are so devised that the machines can alternately act as winding and unwinding machines.

In the accompanying drawing, by way of demonstration, Fig. 1 diagrammatically illustrates one of the possible forms of construction of the bending-winding machines in question, it being understood that other embodiments are possible without departing from the principle of the present invention as long as the strip is wound without the coil being in contact with an inner drum, which is the cause of cooling.

The following description applies to the use of a reversible rolling-mill train, but it is also to be understood that the use of bending-winding machines for any other type of rolling-mill train, for instance a three-high Lauth mill, is also included in the scope of the present invention.

The bending-winding machine comprises a pair of gripping cylinders 1, the lower cylinder being capable of rising and lowering under the action of a compressed air piston 2. It is provided with a set of three bending cylinders 3, 3 and 5, two of which, the lower cylinder 3 and cylinder 5 can move up and down under the action of compressed air pistons 4 and 6. The cylinders 7 are intended to support the coil which forms within the cover 8. All the cylinders 1, 3, 5 and 7 are controlled.

The cylinders which can move up and down under the action of compressed air pistons can retract downwardly as indicated in Fig. 2 so as to allow the passage of rectilinear bars between them and the two upper cylinders of the pairs 1 and 3.

Fig. 3 diagrammatically shows in elevation the assemblage of the bending-winding machines on either side of the rolling-mill housing.

Fig. 4 is a plan view of the same plant.

At 9 can be seen two toothed wheels actuating by chain two pinions 10 respectively placed on shafts controlling the bending-winding machines. 11 illustrates clutches which can drive the bending-winding machines in one direction and in the other, or uncouple them from the shafts actuated by the pinions 10. At 12 can be seen the casings containing the gears which control, through the medium of coupling-rods 13, the cylinders of the bending-winding machines.

The rolling of a strip is effected in the following manner: the blank obtained for instance from a preparing housing and which has been rolled on said housing to a suitable thickness, for instance 50 m/m, is led to the housing equipped with two bending-winding machines diagrammatically illustrated in Fig. 3. The movable cylinders of the bending-winding machines being withdrawn into their lower position, as they are illustrated in Fig. 2, a few rolling passes are first

of all effected without winding, by allowing the strip, which finds its passage between the cylinders of the bending-winding machines, to spread on the cylinders reserved for the rolling-mill housing. As soon as the thickness has reached a certain value for the strip to be wound, for instance 20 m/m, the cylinders 1, 3 and 5 of the bending-winding machine located on the opposite side to that of the strip to be rolled, are lifted, said machine is thrown in gear by the corresponding clutch 11, then the strip is introduced in the rolling-mill. Said strip passes between the gripping cylinders 1, then is bent by the set of bending cylinders 3, 3 and 5 and winds in a coil in the space comprised between the cover 8 and the supporting cylinders 7. As soon as the rear end of the strip issues from the cylinders of the train, the clutch 11 corresponding to the bending-winding machine containing the strip, is uncoupled, and this in such a manner that the end of the strip remains between the gripping cylinders 1. The direction of rotation of the rolling-mill is then reversed. The cylinders 1, 3 and 5 of the bending-winding machine which is actually empty are lifted, the clutch 11 corresponding to said machine is actuated, then, by means of the clutch 11 corresponding to the bending-winding machine which contains the strip at the moment, the latter is engaged in the cylinders of the rolling-mill housing. As soon as the rolling pass has begun, the machine from which the strip unwinds is uncoupled, said machine remaining actuated by the pull exerted by the strip itself during all the remainder of the unwinding period, then the rolling is continued by allowing the strip to wind up into one of the bending-winding machines whilst it unwinds from the other. The cylinders 1, 3 and 5 of both machines remain in the upper position. Use is made every time of the clutches 11 on the machine which is to unwind the strip to send the end of the strip into the rolling-mill, then for releasing said machine from the control, and said clutches are used on the machine which is to wind up the strip for actuating said machine during the winding up, then for uncoupling it as soon as the strip leaves the cylinders of the rolling-mill.

The last pass being effected, the strip is allowed to completely wind up in the corresponding bending-winding machine. After having lifted the cover 8 the coil obtained can then be evacuated, then the cover being lowered, the plant is ready to roll another strip.

PAUL BLAIN.

PUBLISHED P. BLAIN Serial No.

JULY 13, 1943. PROCESS FOR HOT ROLLING VERY LONG THIN STRIPS 470,621

BY A. P. C. Filed Dec. 30, 1942

Fig.1

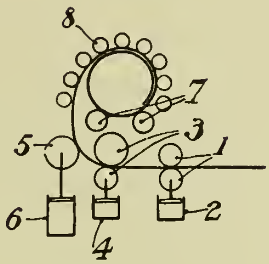


Fig.2

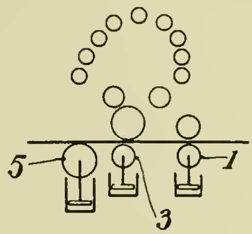


Fig. 3

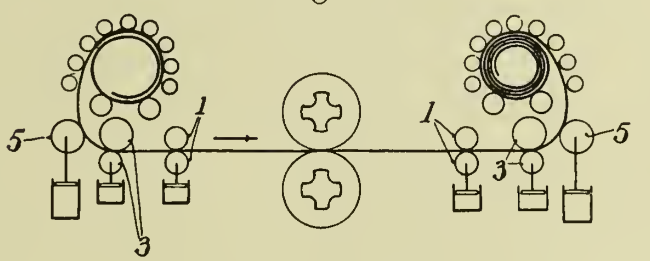
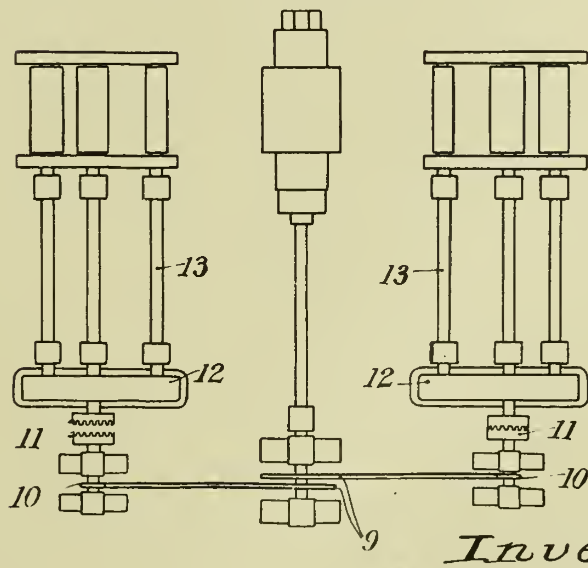


Fig. 4



Inventor
Paul Blain
By Glascock Downing & Seebold
Attys

Published July 13, 1943 Serial No. 470,622

ALIEN PROPERTY CUSTODIAN

METHOD AND DEVICE FOR MAKING THE POINTS OF COLLARS, DETACHABLE COLLARS, CUFFS AND THE LIKE

Georges Germain, Romorantin, France; vested in the Alien Property Custodian

Application filed December 30, 1942

The present invention has for object a method for the mass production of the points of collars, as well as a device allowing a rapid and sure production by a simple operation effected by the worker consisting in turning out and forming the point.

It is known that the collar being stitched, that is to say the two strips of fabric of the collar and the stiffening having been assembled by a line of stitching effected on the wrong side of the fabric, it must be turned out on to the right side. For that purpose, use has been made of devices having piercers, with which the collar is nipped before turning it inside out. Said devices have, however, various inconveniences which are remedied by the method and device according to the present invention.

In the pocket formed by the two strips of fabric forming the point of the collar, nippers are introduced which terminate in two thin and pointed noses. One at least of said noses is held spaced from the other, and means are provided so that, when the noses are engaged up to the bottom of the pocket, the noses can slightly nip the extreme point of the collar which has been previously slightly engaged between them. It suffices at this instant, to turn the pocket inside out, then to loosen the noses for the collar to be correctly turned inside out and ready to be finished.

A device will be described hereinafter allowing to effect this nipping of the point of the collar and turning it out in the minimum of time and by a simple operation.

In the accompanying drawing:

Fig. 1 is an elevation of the device, partly in section.

Fig. 2 is a horizontal section of the nippers according to II—II of Fig. 1.

Fig. 3 is a similar view of the nippers in closed position.

Fig. 4 is a top plan view of the device.

The device comprises a hollow frame **1** of bent shape; in the horizontal bend **2**, provided at the desired height for working, are secured the nippers **3**; said nippers comprise a fixes nose **4** and a nose **5** movable about a fixed pin **6**; the portion **17** of nose **5** located behind said pin is provided with a notch **16** forming two rolling inclines for a roller **7** mounted at the end of a rod **8**. Said rod is pivoted at **10** on one of the arms of the right angle member **9**, the other arm of which is pivoted at **11** to a vertical rod **12** connected to a control lever or pedal, not shown in the drawing. Said right angle member **9** is loosely mounted on a spindle **13** secured to the frame **1**. A returning spring **14** is mounted between an abutment **15** adjustable on the rod **8** and the nippers **3**.

The operation of this device is as follows: In position of rest, the spring **14** pulls the rod **8** in the direction opposed to the noses; consequently, the roller **7** rolls towards the bottom of the notch **16**, rocking the member **17** towards the right, which has for effect to move the movable nose **5** away from the fixed nose **4**.

At this moment the worker fits over said noses the pocket **18** (illustrated in dot and dash lines in Fig. 2) formed by the two thicknesses **19**, **20** of the fabric of the point of the collar and the stiffening **21**, all three assembled by a line of stitching; when the point of the collar is completely fitted over the nippers **3** (position shown in the drawing), it suffices to engage about 1 or 2 m/m of the fabric at the extreme point of the collar between the noses 4 and 5 which are spaced apart. At this moment the worker operates the control lever or pedal; the bell crank lever **12**, **9**, **8** pushes the rod **8** forwardly; the roller **7** rolls on the inclines of the notch **16**, which has for effect to rock the portion **17** of the movable nippers about the pin **6** towards the left and to clamp the nose **5** against the nose **4**. The point of the collar is therefore firmly gripped between the noses of the nippers, as long as the worker actuates the control; it suffices for the latter to grip the pocket **18** and to pull it backwardly for turning the collar inside out. At the end of this operation, the worker ceases to actuate the bell crank lever and the collar is released, the part of the fabric gripped between the noses **4** and **5** forming the point of the collar.

Of course certain details of this device, such as the control of the movable nose, the assemblage of the movable nose or noses, etc. may be modified without departing from the scope of the invention.

The invention is naturally applicable to all kinds of collars, cuffs, wrist-bands, etc., it allows the work to be effected rapidly and surely without any risk of deteriorating the articles the finishing of the points of which is perfect.

GEORGES GERMAIN.

PUBLISHED

JULY 13, 1943.

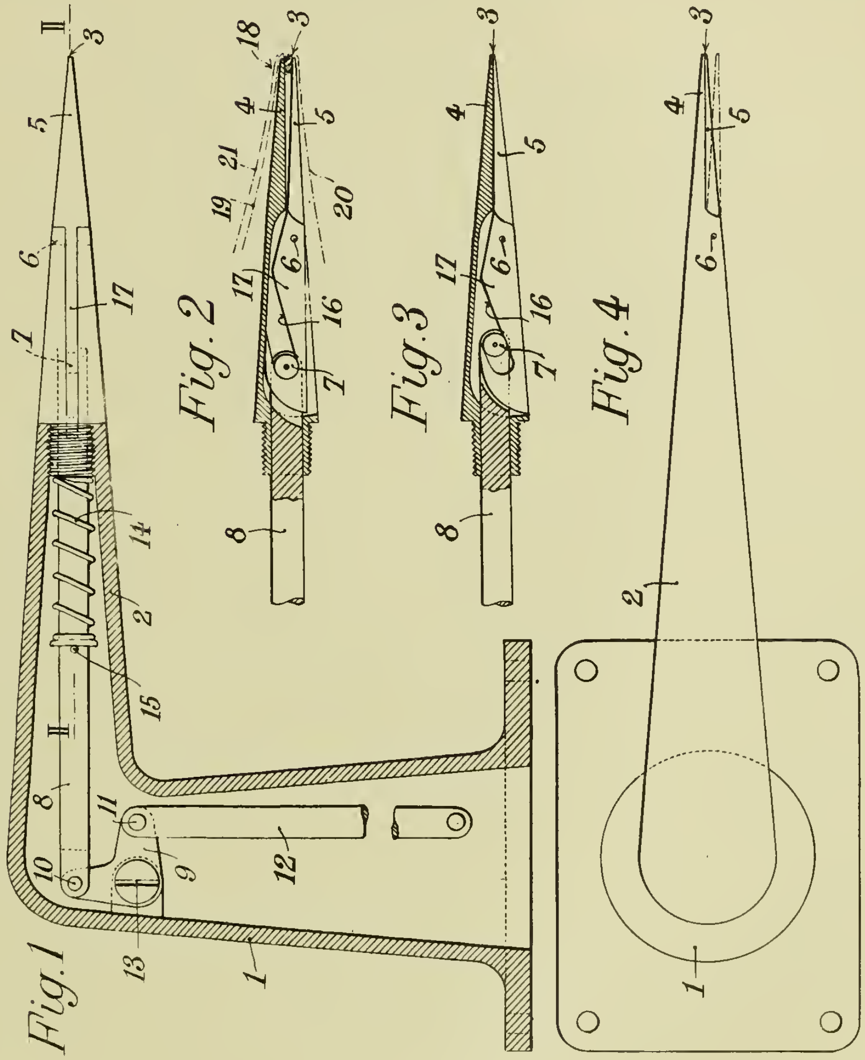
BY A. P. C.

G. GERMAIN

METHOD AND DEVICE FOR MAKING THE POINTS OF COLLARS, DETACHABLE COLLARS, CUFFS AND THE LIKE

Filed Dec. 30, 1942

Serial No. 470,622



Inventor

G. Germain

By Glascock Downing & Seebold

Attys

Published July 13, 1943 Serial No. 470,629

ALIEN PROPERTY CUSTODIAN

ROTARY VANE PUMPS

Charles Raymond Waseige, Saint-Etienne (Loire), France; vested in the Alien Property Custodian

Application filed December 30, 1942

My invention relates to rotary vane pump or compressor for air or other gases of the kind having radial vanes mounted on a shaft co-axial to the casing of the pump for the convenience hereinafter termed barrel, and driven by a rotor arranged excentrically to the barrel.

The main object of my invention is to improve this type of pump more particularly of the design used in the case when conditions of weight, purity of the air and safety of working have a primordial importance as is the case in their use on board aircraft.

It has been in fact verified that in already known pumps of that kind, there occurred jammings of the vanes in their guides and in the barrel, along with a heating of the eyes of the vanes as soon as one tried to rotate those pumps at high speed. I have been led into considering that those inconveniences resulted on the one hand from a bending of the shaft of the vanes under the action of the centrifugal force and on the other hand, from the insufficient lubrication of vanes on their shaft, lubrication which it is impossible to increase without charging the air with an unacceptable quantity of oil.

Another object of my invention is to oppose the bending of the shaft of the vanes and to increase the rotation speed of the pump.

A still further object of my invention is to remedy the heating of the eyes of the vanes.

Other objects of my invention are brought out more fully in the description and claims. By way of in no means limitative example various embodiments of a pump according to my invention have been schematically represented in the accompanying drawing.

In this drawing:

Fig. 1 is a longitudinal section of a pump.

Fig. 2 a transversal section according to the line II—II of Fig. 1.

Figs. 3, 4 and 5 are similar views to Fig. 1 with modifications.

In the examples illustrated, the pump belongs to the type comprising radial vanes **1**, here three in number, freely engaged on a shaft **2** coaxial with the barrel **3** having an air inlet and an air outlet (Fig. 2). A hollow rotor **4** is excentrically mounted in the barrel **3** (the shaft **2** being arranged within the said rotor **4**). At the periphery of the rotor **4** are formed lodgings for guides **5** each of them being mounted for free rotation upon itself in its lodging around an axis parallel with those of the rotor **4** and of the barrel **3**. Each guide **5** is provided with a diametral slot in which a vane **1** is slidably mounted with light friction.

In the embodiment shown in Fig. 1, the shaft **2** crosses the rotor through and through and is supported, on either side of the latter, on the one hand in a ball bearing **7** lodged in an end plate **8** mounted at the end of the barrel **3** and on the other hand in a ball bearing **9** lodged in a rotating member **10** itself supported by a roller bearing **11** fitted into a transversal partition **12** which is mounted to the end of a casing part **13** fixed on the other extremity of the barrel **3**.

The rotor **4** is also supported at its two extremities by ball-bearings **14** and **15** respectively supported by the end plate **8** and the casing part **13**.

The rotating member **10** serves as a driving member of rotor **4** by means of a gearing comprising an intermediary shaft **17** carrying two wheels **18** and **19** of different diameters the smaller of which **18** is in gear with a toothing **20** presented by a member **10** and the other **19** with a toothing **21** supported by the rotor **4**. Therefore this gearing forms a multiplicator of speed. The shaft **17** is fitted on ball-bearings **22** and **23** respectively supported by casing part **13** and partition **12** and extends on the other side of the latter where it presents a worm gear **25** which operates an oiling pump **26** to which leads an inlet canalization **27** for oil under pressure and from where runs a pipe **28** to go and terminate at the extremity of the hollow shaft **2** to secure the lubrication of the eyes **29** of the vanes, though the means of transversal holes **30** provided in this hollow shaft **2**.

Besides, this member **10** serves as a casing to a torque limiting device **31** whose driving piece is an end of a shaft **32** centred on the one hand in member **10** and on the other hand in a roller bearing **33** supported by a cover plate **34** fixed at the end of the casing **13** above partition **12**. It will be noticed that in this disposition, the gears are enclosed in casing part **13** on a same side of partition **12** whereas the torque limiting device **31** and the oiling pump are on the other side, inside the cover plate **34**. The latter bears, for the fixing of the pump in its place, a cheek **35** perpendicular to the rotation axis. The pump is operated by means of the end of the shaft **32** which projects outside cover plate **34**.

The operation of the rotor **4** by the described mechanism is obvious and the remaining working of such a kind of pump is already well-known.

The modification represented on Fig. 3 differs chiefly from the preceding one by the fact that

the driving shaft **32***a* is excentrically arranged with reference to the barrel and operates the rotating member **10***a* through the medium of a single pair of gears **20***a*, **21***a* without an intermediary shaft. Though no torque limiting device has been represented in this case, it is possible to interpose one, similar to that of Fig. 1, between shaft **32***a* and gear **20***a*.

In the further modification shown on Fig. 4, the shaft **2***b* comprises, at the opposite end of the driving shaft **32**, coupling means **40** here formed by splines, which allow to couple another apparatus directly on the pump. The shaft **2***b* is rotated by a toothed wheel **41** fixed upon it and in gear with another wheel **42** fixed on shaft **17***b*. Preferably the ratio of gearing **41—42** differs very slightly from that of gearing **19—21** so that there be a slow relative rotation between this shaft **17***b* and the eyes of the vanes.

The embodiment on Fig. 5 differs from the preceding one by the fact that the shaft **2***c* is driven directly by the shaft **32***c* and comprises, to that purpose, means **43**, coupling it directly with this shaft **33**, formed for instance by splines.

CHARLES RAYMOND WASEIGE.

PUBLISHED	C. R. WASEIGE	**Serial No.**
JULY 13, 1943.	ROTARY VANE PUMPS	**470,629**
BY A. P. C.	Filed Dec. 30, 1942	2 Sheets-Sheet 1

Fig. 1

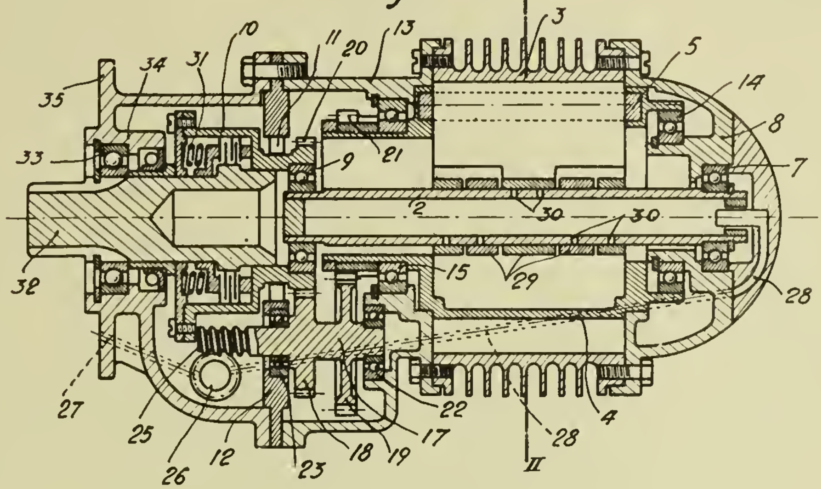


Fig. 2

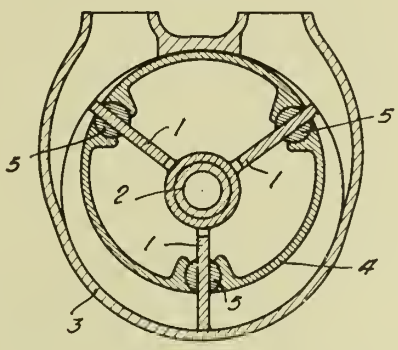
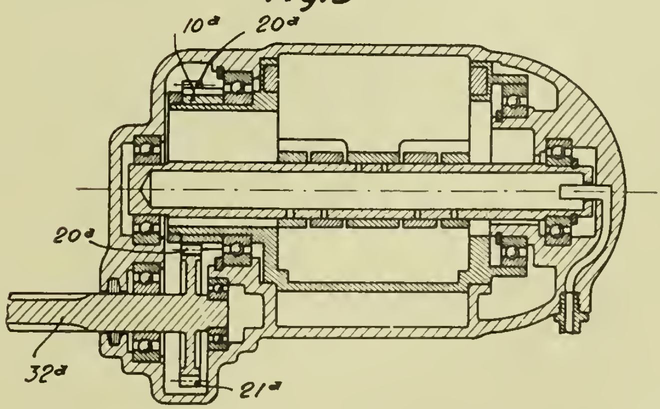


Fig. 3



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C. R. WASEIGE

ROTARY VANE PUMPS

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2 Sheets-Sheet 2

Fig. 4

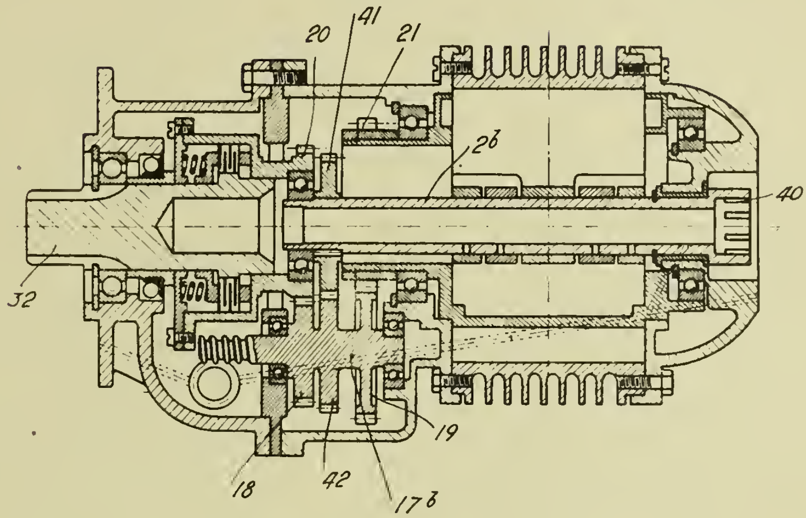
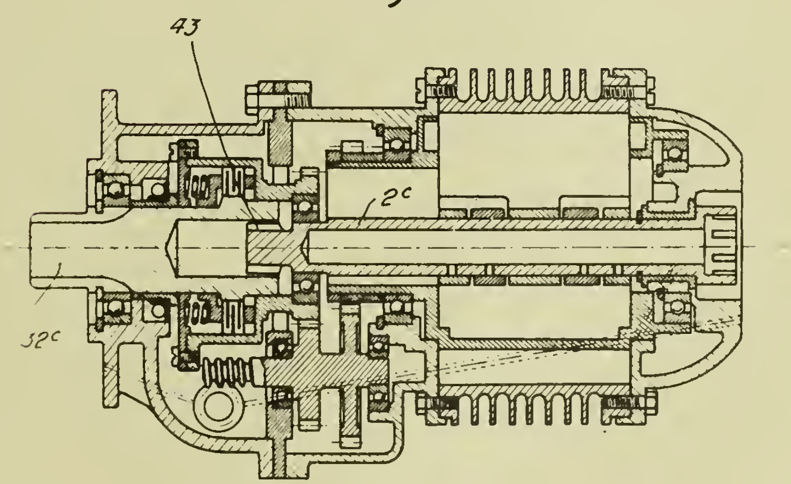


Fig. 5



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Attys

Published July 13, 1943

Serial No. 470,630

ALIEN PROPERTY CUSTODIAN

ADJUSTING DEVICE FOR ROLLING-MILLS

Jean Misset, Firminy, France; vested in the Alien Property Custodian

Application filed December 30, 1942

According to known processes, the adjusting of the rolls in rolling-mill housings is obtained by screws or by wedges, operated by hand or mechanically controlled. These devices have serious inconveniences:

1. The taking up of the play and the resilient distortions of the housings determine a "yielding" of a certain importance, which must be made the best of, when introducing the product into the rolling-mill. A certain dubiousness as regards the importance of the reductions in thickness otbained results therefrom, which are not in simple relation with the adjustment effected, and this dubiousness constitutes an inconvenience for obtaining bars or strips rolled to the desired thickness, when it is impossible to measure the thickness of the product as it issues from the housing.

The yielding causes, moreover, unevennesses of thickness in the rolled products, when the resistance to plastic distortion of the metal is not the same at all the points of the length of the rolled bar or strip. Finally, when rolling strips on straight barrel rolls, an important yielding can be the cause of serious difficulties in the rolling.

All these considerations have led rolling-mill constructors to strive to reduce the importance of the yielding, in particular by increasing the cross section of the uprights of the housing, for causing said members to work at a very low working stress, clearly lower than that which could be admitted simply as regards the resistance of the metal. This results in the rolling-mill housings being very heavy, which may lead, in the case of important rolling-mills, to great constructional difficulties.

2. It is impossible in many cases and, more particularly in hot rolling-mills, owing to the friction forces set in action, to tighten or to loosen the rolls in the course of a pass; in particular, the fact that it is impossible to loosen the rolls presents serious inconveniences when an accident occurs during the rolling.

3. The device is cumbersome, and consequently costly; the forces set in action for the adjustment are out of proportion with the result obtained.

Devices in which hydraulic jacks replaced the screws or wedges, have been tried, but they also present inconveniences which have not allowed their use to become general:

1. The yielding of the jacks due to the compressibility of the liquids at high pressures, is added to the normal yielding of the housings and leads to very high figures, inconsistent with correct rolling.

2. The slightest leakages, difficultly avoidable, produce in the adjustment of both sides of the housing, a lack of balance which cannot be admitted.

The present invention has for object a device according to which the movement for adjusting the rolls is under the dependence of a control system, devised in such a manner as to remedy the above mentioned inconveniences.

This result is obtained by means of a relay, which controls the filling up or the emptying of the adjusting jacks, in such a manner that the yielding is compensated in totality or in part.

The system proposed thus offers the following advantages:

1. Reduction or elimination of the yielding, allowing easier and more accurate rolling, even allowing eventually to automatically obtain a product having a thickness equal to that indicated by the dial of the control apparatus previously adjusted.

2. Possibility of using housings of smaller cross section and weight.

3. Possibility of tightening or loosening the rolls in the course of the pass.

4. Reduced cumbersomeness well clearing the upper part of the housing.

5. Reduction of the energy set in action.

6. To a certain extent, insensitiveness to leakages which may occur in the plant.

The following description applies to the use of a hydraulic control relay, but it is to be understood that the use of an electric or mechanical relay is also included in the scope of the present patent.

Likewise, the use of a hydraulic, electric or mechanical control device for controlling the adjusting device having a screw or a wedge, although it does not allow of remedying all the previously mentioned inconveniences, is also included in the scope of the patent.

In the accompanying drawing, Fig. 1 diagrammatically illustrates, in an embodiment given simply by way of demonstration, a possible form of construction of the device mounted on one of the uprights of a two-high housing; the second upright is equipped in an identical manner and the control shaft disposed with a worm drive K simultaneously actuates both devices (through the medium of a coupling allowing to previously regulate the adjustment on each separate upright).

The upright of the housing A containing the

lower chock B and the upper chock C of the rolls D is equipped with a lifting device E of ordinary type. The adjustment of the upper roll is obtained by means of the hydraulic jack F, the placing under pressure or discharge of which is controlled by the hydraulic relay G, secured to the lower part of the upright of the housing A, and supplied with water under pressure by an accumulator, not shown.

The piston 1 of the hydraulic relay G is attached to the rod H which can screw in the nut I, rigidly connected to the upper chock C. The rotation of rod H is controlled by the wheel J in which the rod H can slide without rotating. The worm wheel J is actuated by the shaft bearing the screw K, operated for instance by means of a hand-wheel and which simultaneously controls the two identical devices of the housing.

Fig. 2 illustrates a diagrammatic section of the relay G, on an enlarged scale.

The body of the relay G is provided with connections 2, 3, 4 connected by pipes 5, 6, 7 respectively to the accumulator for water under pressure, to the adjusting jack, and to the discharge tank.

These connections are in communication with orifices leading to the cylinder 8 of the relay. The piston 1 comprises flanges 9, 10, 11 the dimensions of which are so chosen that in median position—that shown in Fig. 2—the jack is neither connected with the pressure supply nor with the discharge, but that a displacement of small amplitude in one direction or in the other puts the jack in communication with the accumulator through 2—5, or with the discharge through 4—7. A spring 12 tends to bring the device in the lower position.

The operation of the device is as follows:

1. Before a rolling pass, the hand-wheel and the shaft K are actuated, for instance in the direction corresponding to tightening. The rod H rises in the nut I and the piston of the relay puts the jack in communication with the accumulator. The upper roll then approaches the lower roll and actuates the nut I, the screw H and the piston of the relay until the communication is cut off. Everything takes place as if the screw H, acting on the nut I, directly actuated the upper roll, taking a bearing on the relay.

2. During rolling, the relay reacts in the same manner, so as to maintain constant the distance between the relay G and the nut I, that is to say, between the bottom of the housing and the upper chock, thus compensating the "yielding" which results from the resilient distortion of the upright of the housing and from the compressibility of the liquid of the adjusting jack.

3. In case of accident during rolling, it is easy to actuate the hand-wheel for immediately loosening the rolls, as no supplementary stress resulting from rolling can be exerted on the whole of the control device.

The present description has contemplated a possible embodiment of the device in which as application points for the adjustment have been chosen, on the one hand, the lower part of the housing and, on the other hand, the upper chock. A different embodiment, having other application points and, in particular, the rolls themselves (which allows of also compensating the clearances between rolls and chocks) or even the thickness of the rolled product, is also included in the scope of the invention.

It is pointed out that:

The adaptation of the device to a four-high or other cluster mill.

The fact of controlling by the relay provided, not only the adjusting jack alone, but simultaneously the adjusting jack and the lifting jack.

The fact of controlling the control relay through the medium of an amplifying device increasing the accuracy or sensitiveness of the control,

Are also included in the scope of the present invention.

JEAN MISSET.

PUBLISHED
JULY 13, 1943.
BY A. P. C.

J. MISSET
ADJUSTING DEVICE FOR ROLLING-MILLS
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470,630
2 Sheets-Sheet 1

Fig. 1.

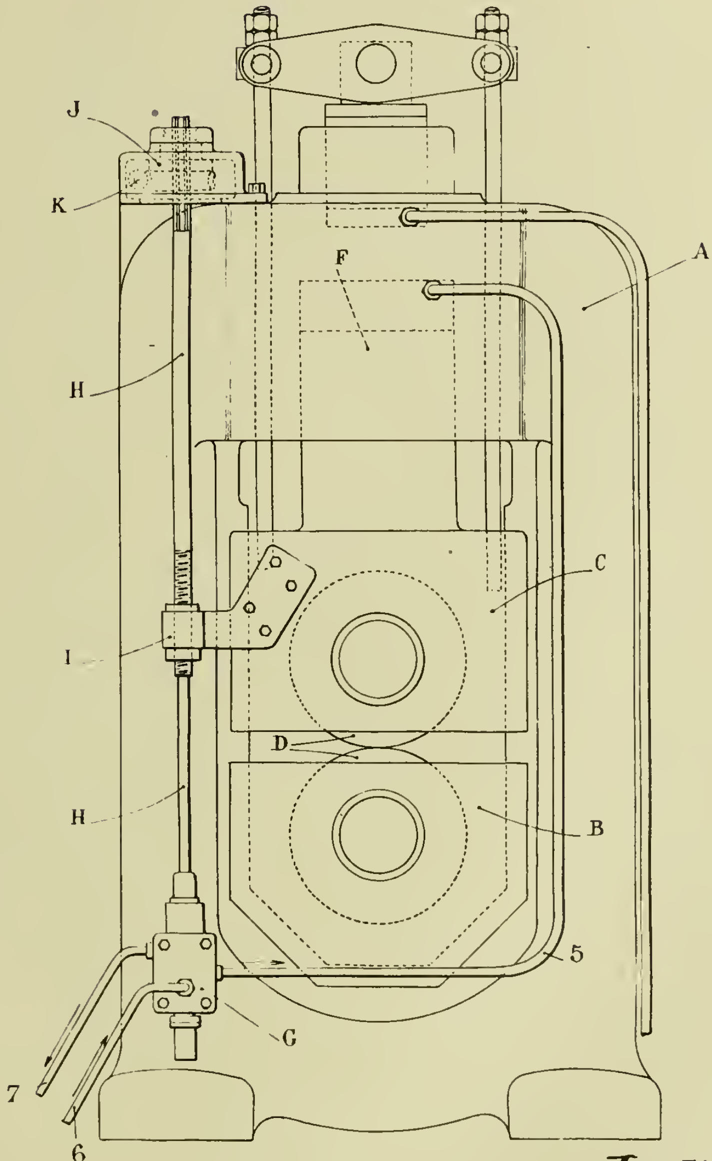

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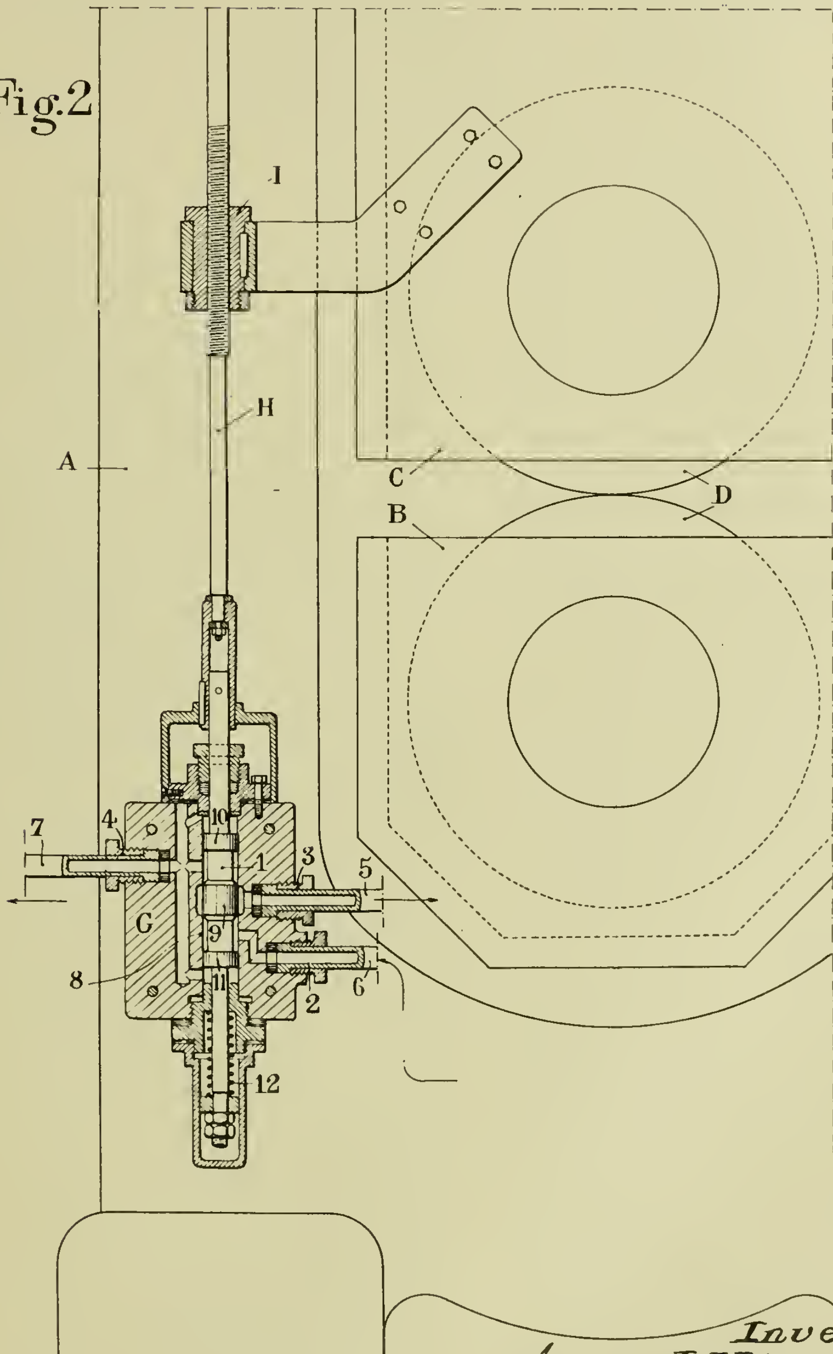
Fig. 2



Inventor
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Attys

Published July 13, 1943

Serial No. 470,674

ALIEN PROPERTY CUSTODIAN

PROCESS FOR OBTAINING MOISTENING, FROTHING, EMULSIFYING AGENTS AND DETERGENTS FROM COCOA-NUT OIL, PALMISTIC OIL, PALM OIL, ETC.

Jean-Camille Roger-Petit, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed December 30, 1942

For a long time past, use has been made, in the most varied industries, of moistening, frothing, emulsifying agents and detergents, for instance, in mining industries (flotation) textile industries (cleaning agents, adjuvants), dyeing, bleaching, tanning industries (impregnating agents), beauty products (emulsifying agents), insecticides for agriculture (moistening agents) etc. constituted by sulphonated fatty alcohols or other fatty alcohols compound prepared from natural oils, such as cocoa-nut oil, palmiste oil, palm oil, etc.

For that purpose, the product are usually employed such as they are; sometimes, however, a rough fractionation is effected which eliminates the tops and bottoms, for instance for obtaining technical lauric alcohol, but, in all cases, more or less varied compounds of a more or less large number of products are obtained.

Now it has been found, according to the present invention, that it is possible to obtain from cocoa-nut oil, palmiste oil, palm oil, and other natural or artificial oils, much more valuable moistening, frothing, emulsifying agents and detergents by effecting, for instance, a systematic fractionation, so as to obtain definite products instead of a mixture of various bodies.

This supplementary operation which is effected according to the present invention, is obviously costly and requires suitable apparatus, but the supplementary expenses resulting therefrom are amply compensated by the result obtained; in fact with the usual practice, the moistening agents obtained are constituted by various definite bodies which sometimes have clearly antagonistic properties; furthermore, their composition varies according to the climate, the soil of the country in which the oil treated was produced, and even according to years. It is therefore necessary to use, for obtaining the desired result, quantities of products greater than is strictly indispensable, which quantities can moreover vary from one sample of the product to another. On the contrary, by using definite products, that one can be chosen which possesses to the maximum the required properties, more or less high solubility at the temperature of operation, more or less high moistening power at said temperature, etc.

Also, according to the present invention, starting from the definite products obtained, well defined mixtures of said definite products can be made, so as to use to the maximum the properties of each of them for the result to be obtained, or to improve certain mixtures by the addition of definite products possessing to the maximum the desired properties.

A preferred method for carrying out the invention consists in effecting in the usual manner, a reduction of the oils treated, so as to obtain a mixture of fatty alcohols, usually hexylic, octylic, decylic, dodecylic or lauric, tetradecylic or myristic, hexadecylic or cetylic, octodecylic or stearic and oleic alcohols, in various proportions according to the nature of the body treated, and in separating each of said well defined fatty alcohols by using for that purpose a sufficiently powerful column.

The following examples, show simply as an indication and not in a limiting sense, some of the possibilities offered by the invention:

Example 1

Pure octylic alcohol is etherified by sulphuric hydrochlorine in the following manner:

In a fluid-tight enamelled cast iron apparatus, provided with stirring means and cooled by a circulation of brine, is poured: Pure octylic alcohol, 130 kgs. Then, gradually and without exceeding a temperature of 10°, is added chlorosulphonic acid, 116 kgs. 5. The following reaction takes place:

$$CH_3(CH_2)_6CH_2OH+SO_3HCl \\ =CH_3(CH_2)_6CH_2OSO_3H+HCl$$

The hydrochloric acid which evolves is sent into an absorbing plant. When all the hydrochlorine has been poured, the remainder of the hydrochloric acid is driven off by a current of inert gas such as nitrogen.

210 kgs. of acid octyl sulphate are obtained which are neutralized by pouring them into 133 kgs. of caustic soda lye at 30%, without exceeding the temperature of +5°. This can be effected in a double bottom vessel made of enamelled cast iron also cooled by a circulation of brine.

343 kgs. of a solution of octylsulphate of soda are this obtained titrating 37,5% of combined octylic alcohol. Said solution is in the form of a fine very pale yellow oil having a remarkable moistening, frothing and penetrating power, even at a very low temperature.

Example 2

158 kgs. of decylic alcohol are treated with 80 kgs. of pure sulphur trioxide gradually introduced in the alcohol without exceeding the temperature of +5° and by using an apparatus similar to that used in Example 1.

The sulphur trioxide is preferably used as a liquid or sent in the state of vapour, drawn along

or not by an inert gas, such as nitrogen. It is advantageous to provide a very thorough stirring so that at no moment is there an excess of sulphur trioxide in contact with the alcohol.

238 kgs. of acid sulphate are thus obtained which are neutralized with 17 kgs. of anhydrous ammonia, or with ammonia at 30%, or with 168–170 kgs. of triethanolamine, while the temperature during neutralization must not exceed 10–15°.

The decylsulphates obtained are yellow brown oils, clearly soluble in water and also having a remarkable moistening, frothing and dampening power, even in a very diluted solution.

Example 3

186 kgs. of pure lauric alcohol are treated with 110 kgs. of ordinary sulphuric acid at 66° Bé. The water from the reaction is eliminated by azeotropic drying by using as draining liquid 100 to 200 kgs. of benzene, petroleum ether, methyl ethyl ether, ethyl ether, trichlorethylene, carbon tetrachloride, etc.

The temperature of the liquid during the reaction is maintained between 10 and 20°. For that purpose, the boiling point is adjusted by producing a suitable vacuum if the liquid chosen boils at a temperature higher than 10–20° C.

When there is no longer any water given off, which requires several hours, the operation is stopped, then the solvent is distilled under vacuum and 266 kgs. of lauryl sulphuric acid are thus obtained which are neutralized with 133 kgs. of soda lye at 30% without exceeding the temperature of 10°.

A cream coloured paste is obtained which can be used as such, or dried in an atomising drier for obtaining a white powder of anhydrous lauryl sulphate of soda.

Said product is in the form of a white powder very soluble in water having a very high frothing, moistening and detergent power, even when highly diluted.

Its efficiency is at least double that of technical lauryl sulphate of soda which contains high doses of decylic, tetradecylic and even cetylic alcohols.

Example 4

Each time that it is desired to increase the solubility in the cold state and stability in hard waters of a definite moistening product, it will be advantageous to add a small quantity of pure hexyl or octyl sulphate of soda.

Example 5

Certain sulphonated alcoyl aryl condensation products give a fine froth but which does not last, that is to say it is not stable and rapidly falls. Said stability is greatly increased by adding a small quantity of triethanolamine tetradecylsulphonate.

Example 6

For obtaining, in certain detergent preparations for liquid or pasty cosmetic products, a fine pearly aspect, it suffices to introduce a certain quantity of a sulphonated derivative of cetylic or stearic alcohols.

Example 7

The viscosity of preparations containing solvents in the emulsified state is considerably increased by passing from the lower terms to the higher terms of the sulphonated fatty alcohols utilised as emulsifying agents.

These few examples show some of the numerous possibilities offered by the invention, owing to which, starting from raw materials currently used at the present day, but in a different manner, products can be obtained which are much more valuable than those obtained up to now, or said products can be greatly improved. In the foregoing, as raw material, cocoanut oil, palmiste oil, palm oil, etc. have only been cited because they are the most commonly used in France, but of course use can be made of the process according to the invention, without modifying the principle thereof for the treatment of other raw materials capable of yielding fatty alcohols.

ROGER-PETIT.

Published July 13, 1943

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR MEASURING LOW DIRECT VOLTAGES

Cornelis Dorsman, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed December 30, 1942

For measuring small direct voltages, and more particularly for measuring the terminal voltage of a source of direct current having a very high internal resistance, devices have come to be known in which the direct voltage to be measured is converted into alternating voltage by means of a condenser which is charged by the direct voltage to be measured, means being provided by which the condenser capacity is periodically altered. From the condenser an alternating voltage may then be taken whose amplitude is proportional to the value of the direct voltage supplied thereto, which alternating voltage, after having been amplified and, if desired, rectified can be measured in a simple manner. Such devices may also be used with advantage for determining the value of direct voltages by means of a compensation method, in which the obtained accuracy depends on the accuracy with which the difference in value of the unknown direct voltage and a known direct voltage can be measured.

We have found that the accuracy with which a direct voltage can be measured by means of the devices referred to above is comparatively small, since it generally amounts only to about 0.020 volt.

The invention provides an improvement of devices of the kind referred to above, thus reaching a much greater accuracy in measuring.

According to the invention the electrodes of the condenser, which is loaded by the direct voltage to be measured, are flat and parallel and so arranged as to be movable with respect to one another solely in a direction normal to the plane of the electrodes by the said means for periodically varying the condenser capacity.

The invention is based on the realisation that the said small measuring accuracy is due to the difference in contact potential of the two condenser electrodes, owing to which the condenser will always exhibit a definite charge even if no charge is supplied to it. Since the contact potential of a metal surface is different from point to point the difference in contact potential between the electrodes, which is approximately independent of the distance between the electrodes, will be constant only if upon varying the condenser capacity by relative displacement of the electrodes the active electrode surface remains always the same and, moreover, the ratio between the contribution towards the total condenser capacity delivered by any part of the active electrode surface and the total condenser capacity always remains the same which is ensured, according to the invention, by taking the steps referred to above.

In order to achieve that the difference in contact potential does not alter eventually it has proved advantageous to house the condenser in hermetically closed envelope and a chemically inert atmosphere, preferably in a vacuum, thus avoiding alterations of the contact potential by atmospheric and/or chemical agency.

By the said expedients it is achieved that the difference in contact potential of the electrodes is invariable, in contradistinction to that of the known devices. Thus the value and polarity thereof can be determined and particularly when considering them in making measurements a much greater measuring accuracy is obtained than is feasible by means of known devices.

In order that the requirements imposed on the accuracy of the mechanical structure of the condenser, in conjunction with the desired measuring accuracy, shall be as small as possible it is advisable that the electrodes of the condenser should be made from a metal having such properties that the difference in contact potential of two electrodes made therefrom is naturally very low. In conjunction therewith it has proved advantageous to make the electrodes from electrolytic red copper.

Since by the above steps the difference in contact potential of the condenser electrodes is constant, at variance with that of known devices comprising variable condensers, for instance by rotation of one of the electrodes, the difference in contact potential of the electrodes can be made up for, according to the invention, by supplying to the condenser a constant direct voltage which is equal but opposite to the difference in contact potential of the condenser electrodes. This may be made with advantage more particularly in making measurements according to the compensation method in which case the unknown direct voltage and the direct voltage for comparison are exactly equal, if no alternating voltage at all is set up at the condenser having a variable capacity to which is supplied the difference of the two direct voltages, which can be readily ascertained by means of sensitive amplifying devices controlling a volt- or ammeter of the usual type or another indicating device such as a cathode-ray indicator, so that a very great measuring accuracy can be obtained.

CORNELIS DORSMAN.

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BY A. P. C.

C. DORSMAN

DEVICE FOR MEASURING LOW DIRECT VOLTAGES

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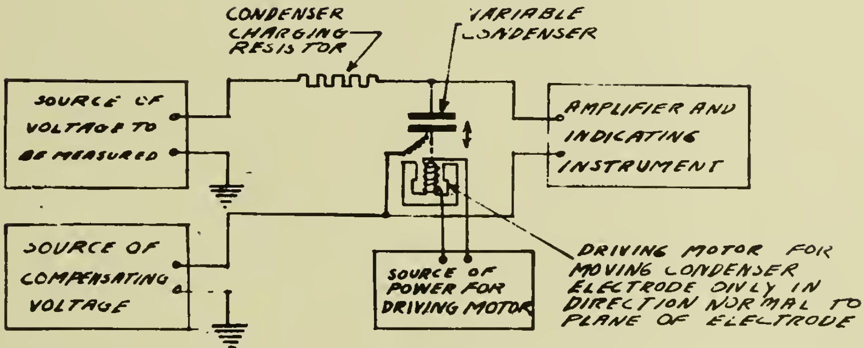

PH-7340

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Attorney

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ALIEN PROPERTY CUSTODIAN

PROCESS OF MANUFACTURING A COMPOSITION FROM WASTE LIQUOR OF CELLULOSE

Eberhard Rheinberger, Berlin, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 14, 1943

The invention relates to a process of manufacturing a composition from waste liquor of cellulose.

Waste liquor of cellulose is known to be the residual liquor obtained by the various methods in the manufacture of cellulose. Heretofore such waste liquor could not be utilized for the most part. Some constituents of the liquor have been recovered indeed, such as, for instance, vanilline or alcohol. It ihas also been suggested to precipitate part of the liquor by adding chemicals and to use the precipitation for the manufacture of pressed articles. In all of such cases, however, a very large portion of the waste liquor remains unsued. In addition, the processes of obtaining the precipitation are relatively cumbersome and expensive, and the pressed articles made from such precipitations show a good deal of defects as regards hygroscopicity, strength and capability of being pressed.

The invention provides a process adapted to convert the totality of waste liquor into a homogeneous composition.

In particular, the invention has for its object the mixing of the waste liquor with chemicals of such kind as to form, in its entirety, a homogeneous composition, preferably a gel.

Another object of the invention is the preparation from waste liquor of a composition which may be used as kind of a synthetic resin.

Another object of the invention is the composition proper obtained from waste liquor. A composition of this kind may be used with or without filler or with or without dyestuffs. For example, it may be used for varnishlike coats or as glue. If it is desired to use it as a molded plastic, it will as a rule be convenient to mix it with fillers and, if necessary, also with agents improving both the ability of flowing and ability of sliding of the composition during the pressing operation. The composition may then be pressed under pressure and heat as well as worked by die casting.

According to the invention, the waste liquor will be treated with a cyanamide compound of the alkaline-earth metals until it is converted into a homogeneous composition. A most satisfactory cyanamide compound of this kind has proved to be calcium cyanamide. The waste liquor is preferably used after being concentrated to 30° Bé. Liquor not being thickened may also be used. Hereinafter it is always referred to a liquor already concentrated to 30° Bé. When using a thinner liquor for the examples specified hereunder, a correspondingly larger amount of liquor will have to be used. It is not necessary to treat the liquor beforehand, but waste liquor treated already, particularly waste liquor from which alcohol has already been extracted, may also be used.

It has been found suitable to reckon about from 30 to 250 grams of calcium cyanamide in 150 to 300 grams of concentrated liquor and to stir up these substances at a temperature ranging from 50° to 100° C. It is also possible to carry out the mixing at a lower temperature, but in this case the process will require more time. While being stirred at a slight heat the mixture being thinly liquid at the beginning will soon be converted, in its entirety, i. e., without any residue, into a tough, gel-like composition. This composition may be dried and used in the form of a synthetic resin. If it is desired to use the composition for the manufacture of molded plastics, it will be suitable to add the filler, e. g., from 50 to 200 grams of wood meal, to the above composition and also, if desired, to add sliding wax and coloring substances and then to dry the total composition to a moisture content of from 3 to 5 per cent. and to grind the dried composition to give a uniform granulation. This pressing powder may then be pressed preferably at temperatures ranging from 160° to 180° C.

To increase the ability of flowing it is recommended, according to another object of the invention, to add easily fusible, inorganic salts or easily fusible, organic compounds; according to an object of the invention, particularly nitrates, nitro compounds or nitric acid treated substances, especially organic matters, such as, e. g., tar, mineral wax, phenol, urea, are used for this purpose, said substances being referred to hereunder as "nitro substances."

For example, in the mixture above referred to, an amount of from 2 to 30 grams of montan wax may be mixed with from 5 to 30 cu. cm. of concentrated nitric acid and added to the calcium cyanamide in heated condition prior to the calcium cyanamide being stirred up with the liquor.

The produce compositions having definite properties it will be suitable to treat the liquor with the cyanamide compound of the alkaline-earth metal at a higher temperature and higher pressures. In such cases the treatment in the autoclave at temperatures ranging from 200° to 500° C. and the resulting pressures has proved satisfactory. Also in this case it is recommended when making molded plastics to add the easily fusible inorganic salts or organic compounds or "nitro substances" to the composition to be treated in the autoclave. The composition treated in the autoclave will then be inspissated to the desired consistency and may be mixed with fillers, coloring substances and sliding waxes, ground and pressed.

EBERHARD RHEINBERGER.

Published July 13, 1943

Serial No. 474,319

ALIEN PROPERTY CUSTODIAN

DAMPING FLY-WHEELS

Henri Louis Burnat, Paris, France; vested in the Alien Property Custodian

Application filed February 1, 1943

The present invention has for object a fly-wheel of variable inertia, intended to damp the tangential vibrations transmitted by a rotary shaft, and of the type comprising a cavity containing a liquid, the mobility of which relatively to the solid part of the fly-wheel creates by friction, an absorption of energy which produces the damping of the tangential vibrations.

Preferably, the liquid must have a specific weight as great as possible, which practically leads to the use of mercury.

The mobility of the liquid mass relatively to the solid part of the fly-wheel can be varied, according to this invention, by the fact that the passage for the liquid in said cavity is variable as to shape and/or cross section either in the circumferential direction, or in the axial direction, or in both said directions. It is for instance possible to cause the liquid to flow circularly through calibrated orifices formed in partitions symmetrically arranged in a cavity having the shape of a body of revolution, the braking action on the liquid being so much the more intense as the speed variation is more important. Certain important effects might be obtained by using viscous liquids, in order to increase the friction effect of the liquid on the walls of the cavity or through the calibrated orifices in the partitions of said cavity.

When the fly-wheel is mounted on a shaft which rotates at a single definite working speed, the cavity in the shape of a body of revolution is preferably completely filled with the heavy liquid, so as to have the maximum inertia, therefore the maximum efficiency.

When the fly-wheel is mounted on a shaft having a plurality of working speeds, the cavity in the shape of a body of revolution can be only partly filled, so that the inertia of the structure can vary according to the speed used, by the displacement of the centre of inertia of the liquid.

In the case of a fly-wheel intended to operate at several different working-speeds, use can be made of a fly-wheel having a vertical axis, the cavity of which in the shape of a body of revolution is only partly filled with the liquid, so that the inertia of the whole varies according to the speed. The cavity in the shape of a body of revolution can even be given a suitable profile for increasing this effect, or its generatrix can be given a certain inclination relatively to the axis of the fly-wheel, so that the liquid mass, under the action of centrifugal force, moves vertically and that the radius of rotation of its centre of inertia varies in function of the instantaneous speed, thereby causing the total inertia of the fly-wheel to vary.

In fly-wheels constructed according to the principles above set forth, the liquid, upon starting, facilitates the latter, by only gradually acquiring the working speed of the fly-wheel; likewise, upon stopping, the latter is facilitated by the fact that the speed of the liquid is always greater than that of the fly-wheel. Upon starting, there is absorption of energy, and the latter is restituted upon stopping.

Likewise, during operation, when the working speed has been attained for some time, the two solid and liquid masses of the fly-wheel rotate at the same speed; if, at this instant, a disturbance takes place in the speed, the liquid mass immediately moves to act in antagonism to said disturbance; the disturbing energy is braked by the absorption of energy produced by the friction effects of the liquid on the walls or in the calibrated orifices.

The invention will be more clearly understood by referring to the accompanying drawings, which show, by way of example, various embodiments for carrying the invention into practice based on these main principles, and in which:

Fig. 1 is an elevation of a fly-wheel having a horizontal axis, according to the invention;

Fig. 2 is a section according to line 2—2 in Fig. 1;

Fig. 3 is a section similar to Fig. 2 showing a fly-wheel having a vertical axis;

Fig. 4 diagrammatically shows a modification of Fig. 3;

Fig. 5 is a section similar to Fig. 3, showing a fly-wheel having a vertical axis and a conical wall;

Fig. 6 diagrammatically shows a modification of Fig. 5.

Referring to Figs. 1 and 2, 1 designates the solid part of the fly-wheel, which comprises, near its periphery, a cavity 2 in the shape of a body of revolution containing a liquid, such as mercury, which completely fills the cavity 2.

The cavity 2 is obstructed at intervals by blades or solid portions 3, leaving between them and the walls of the cavity calibrated orifices 4. These blades are uniformly spaced apart along the circumference so as to obtain a static and dynamic equilibrium.

The fly-wheel can be directly mounted on the shaft the vibrations of which are to be damped, when the speed of said shaft is sufficient, or it can be mounted on an intermediate shaft me-

chanically connected to the main shaft and to which is imparted a sufficient speed of rotation by any suitable transmission members, so that it is possible to proportion the efficiency of the fly-wheel by its own mass, by that of the mercury and by its speed of rotation.

In the example of Fig. 3, the fly-wheel rotates about a vertical axis and the mercury only partly fills the internal cavity, *a* designating the free surface of the mercury. Moreover, the shape of the openings **3** is such that the section of passageway for the circumferential flow of the mercury is greater when the mercury is projected by centrifugal force against the cylindrical wall than at slow speeds, for which the mercury occupies the bottom of the cavity **2**.

The arrangement of the fly-wheel, the cross section of the blades, the various openings formed therein, can be such that said elements are in contact or not with the mercury in position of rest, and that the effect of the openings in the blades intervenes in totality or in part only for certain speeds, determining the distance separating the mass of mercury from the axis of rotation.

The efficiency of the fly-wheel is, by this means, function of the speed of rotation of the shaft.

The result to be obtained being to cause the vibrations of the rotating spindle or shaft to be damped by corresponding displacements of the mercury, displacements which are in their turn braked by the openings formed in the obturating blades, the shape and cross section of said openings will be adjusted in function of the frequency and of the amplitude of the vibrations to be damped.

In the example of Fig. 4, the openings **4** are located towards the centre, so that the section of passageway is maximum at slow speeds and becomes reduced to that of the openings **4ª** at high speeds, when the mercury is projected by centrifugal force against the cylindrical walls.

The openings **4ª** might even be done away with, in which case the mass of mercury will form a block with that of the solid portions of the fly-wheel for a sufficiently high uniform speed of rotation. In this latter arrangement of the fly-wheel of variable inertia, the damping effect on the vibrations results from the mobility of the mercury in the space comprised between two consecutive blades **3**, the instantaneous accelerations or decelerations resulting in a rush of the mercury against the down-side or up-side blade, respectively, with correlative modification of the radius of rotation of the mass of mercury.

In the example of Fig. 5, the variation of the radius of rotation of the mercury in function of the speed is amplified by giving a conical shape to the outer wall of the cavity **2**.

Upon starting, the radius of rotation of the mass of mercury is R. When the speed of rotation of the fly-wheel is sufficient, the entire mass of mercury is projected by centrifugal force towards the large base of the cone and the free surface of the mercury is at *a'*, the radius of rotation becoming R'.

Each particle of mercury is subjected to a variable force representing the resultant of its weight and of centrifugal force. To each speed of rotation corresponds a different free surface *a'* and a radius of rotation R', so that the variation of inertia of the fly-wheel is progressive. The openings **4'** are arranged in such a manner that they enter in action for the normal working speed of rotation of the fly-wheel.

In the example of Fig. 6, the fly-wheel comprises a conical part **5** and a cylindrical appendix **6** or of less conicity, so as to modify the law of progressivity of the variation of inertia in function of the speed. A screen **7**, providing calibrated openings **8**, can also be arranged to brake the flow of the liquid from part **6** into part **5** under the action of centrifugal force.

In this example, the mercury is drawn along by friction against the walls of the cavity. The surface condition of said walls determines the importance of the friction of the mercury.

It is to be understood that the invention is not limited to the few examples above described and a large number of arrangements can be devised based on the same principle and consequently are included in the scope of the invention.

HENRI LOUIS BURNAT.

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BY A. P. C.

H. L. BURNAT
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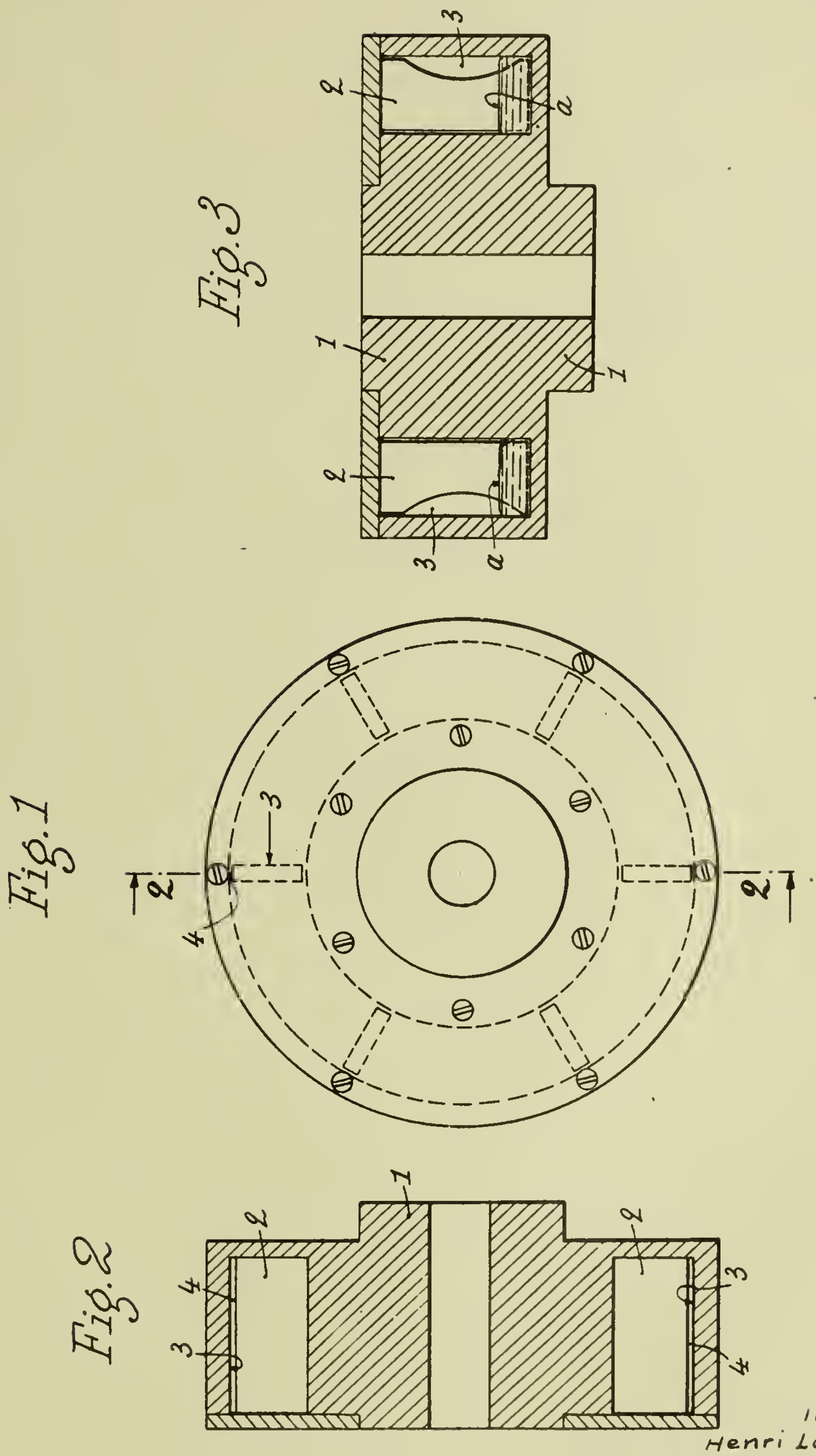
2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4

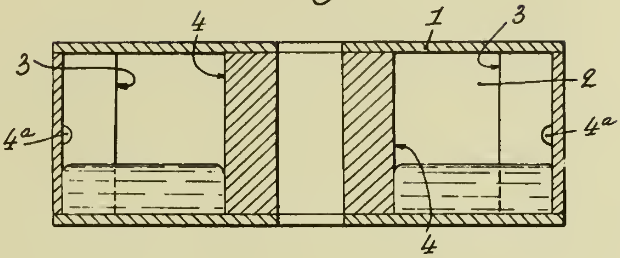


Fig. 5

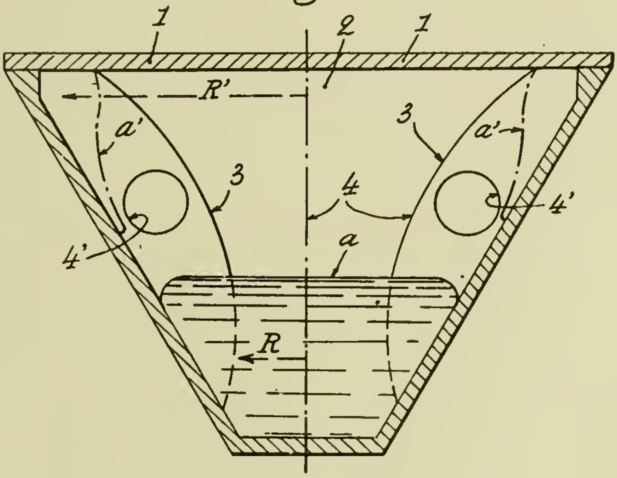
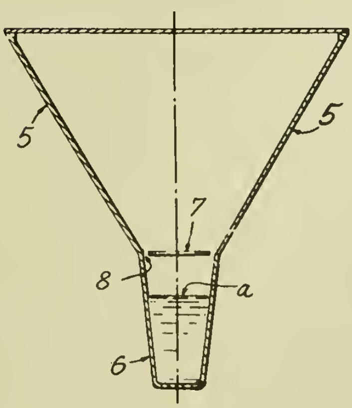


Fig. 6



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Published July 13, 1943 Serial No. 474,320

ALIEN PROPERTY CUSTODIAN

SUBSTITUTES FOR PAPER, CARDBOARDS AND ARTIFICIAL LEATHER AND PROCESSES FOR THE MANUFACTURE THEREOF

Maurice Désiré Emile Déribéré, Courbevoie-Becon, France; vested in the Alien Property Custodian

No Drawing. Application filed February 1, 1943

The present invention relates to the production of continuous or discontinuous sheets intended to be printed by hand or by machine and for all known uses of paper, cardboards or artificial leathers, such as wrapping, folding, protection, presentation, printing, writing and publishing, as well as all transformations having papers, cardboards or artificial leathers for basis.

The invention resides in the discovery that certain mineral materials, having definite physico-chemical properties, can constitute, provided they are utilised in a suitable manner, a foundation raw material and a substitute for cellulose and all other fibres used in the manufacture of papers, cardboards and artificial leathers, as well as sheets already possessing, independently of any addition, an inherent cohesion and flexibility comparable to sheets obtained from cellulose materials or the like used in the manufacture of paper, cardboards and artificial leather.

One of the necessary conditions which the mineral material must satisfy is that it must have a fibrous molecular structure, said structure being moreover not necessarily revealed by the macroscopic aspect of the material. Precise details will be given hereinafter concerning what is meant by "fibrous molecular structure."

All mineral materials having such a structure are however not suitable. A second condition to be satisfied by said materials is that they must be capable of being put into relatively stable suspension in water, after being crushed to a sufficiently fine state, without however it being necessary to reach a gel or colloidal solution.

It is furthermore necessary that the mineral material should swell to a certain extent when it is put in suspension in water.

Finally, the particles of the materials must have an electric charge, so that an orientation or setting of the micellae takes place when the sheets are formed.

Experience shows that if mineral substances satisfying these four conditions, are crushed to a suitable degree of fineness and put in stable suspension in water, it is possible to obtain from such suspensions, by sedimentation, films which, after drying, have such a cohesion and flexibility that, in consideration of a sizing and other treatments or additions usual in paper-making, a substitute for paper, cardboard, and artificial leather can be obtained from these materials, which is capable of receiving the same applications as paper, cardboard and artificial leather themselves.

It seems that the cohesion of the films obtained from these suspensions is due to an arrangement or imbrication of the crypto-crystals of the material, which would explain:

1. The necessity of starting from a material in a state of fibrous cryptocrystallization.

2. The necessity of putting in suspension, of swelling and of the presence of an electric charge, so that each particle should have, upon drying, a freedom of movement sufficient for assuming, under the effect of the electric reactions between the adjacent particles, a well defined position of equilibrium or orientation, the cohesion appearing to be due to said orientation of the molecules or particles of material.

Whatever may be the value of this attempt to give a scientific explanation, the applicant has found that the result sought for was obtained every time that the material satisfied the above-mentioned conditions and that, on the contrary, the result was null, or very poor, when one of them was not satisfied, as will be seen from the examples given hereinafter.

The invention, which is based on the above-defined facts, consists in bringing to a state of suitable division, a mineral material having a fibrous molecular structure, capable of being put in relatively stable suspension in a liquid, of appreciably swelling in said liquid and the particles of which are electrically charged, putting the material thus divided in stable suspension in a liquid, forming a film of suitable thickness from said suspension, drying said film and incorporating with the material before, during, or after the formation of the film, all sizing substances, charges, plasticizers, supplying substances or the like as is usual in paper-making.

The invention has also for object, by way of new industrial product, a substitute for paper, the basis of which is constituted by a mineral material having a fibrous molecular structure, capable of being put in stable suspension in a liquid, of appreciably swelling in said liquid, and the particles of which are electrically charged.

Among the mineral materials having the above-indicated properties capable of forming, by deposition, homogeneous sheets, are included various minerals which exist in nature in a suitable form: tremolite, crocidolite, chrysotile, amosite, palygorskite, sepiolite and, in a general manner, minerals having a fibrous, cork-like, papyraceous structure, known under the denominations of mountain leathers, cardboards and papers, asbestos, etc., as well as analogous minerals having a structure of the same kind, but finer and

which is not macroscopically apparent in such an obvious manner.

Thus, white, light Tyrol tremolite, having the appearance of cork (mountain cork) which is tough but does not present fibres macroscopically, has given, when crushed, a homogeneous suspension. Said suspension deposited on a glass plate, then dried, gave very homegeneous, strong and tough sheets. With medium crushing, a few irregular fibres in the final sheet obtained will be noticed under the microscope. When the crushing is very fine, said fibres are inexistent, but the sheet is quite as tough.

Asbestos materials have also given coherent sheets, but after fine crushing during which the apparent fibres are destroyed and are no longer visible, either in the suspension, or in the sheet obtained, at the greatest magnifications of the microscope. This crushing is necessary, however, for causing two further indispensable conditions to appear: the fineness and the swelling property both attached to colloidal or pseudo-colloidal forms.

In fact it appears very important that the elementary particles should be put in relatively stable and homogeneous suspensions and that the deposit leading to the formation of the sheets should be slow and more function of the drying than of a precipitation.

Indeed, in a suspension suitably prepared for obtaining satisfactory sheets, if the deposit is accelerated by a secondary action, for instance by modification of the pH, the sheets obtained are no longer coherent or the material cracks and is deposited without forming sheets.

Swelling is also a necessary secondary condition. Phyllites such as talc, kaolin, mica, do not form sheets, as these materials, even well crushed, do not swell.

Palygorskite from Nijni Novgorod (U. R. S. S.) right bank of the Oka (sample which is a specimen of No. 110,358 of the collection of the Natural History Museum in Paris) which has given stiff sheets, swells to about seven times its volume as the Table mineral (C. R., des séances de l'Académie des Sciences t. 198, p 1795, 1934) and Tyrol tremolite. Very coherent sheets have been obtained with crushed asbestos materials swelling only from two to three times their volume.

All the substances having given rise to the formation of sheets, are given negative electric charges and distinctly migrate towards the positive pole when they are subjected, in the form of a suspension, to the action of an electric field. A voltage of 10 to 20 volts is always sufficient for ensuring a deposit on the anode, the electrodes being constituted by a nickel or platinum plate for the cathode and by a nickel or platinum wire for the anode.

The action of the pH seems accessory. It is very marked for suspensions on which it has a responsive effect and not for the others. It therefore does not act directly, but by its action on the sedimentation and swelling.

The Table mineral is only very slightly influenced by the surrounding pH. Its suspensions have the same stability on all the pH values 3 to 12. In an alkaline medium there is only a slight thickening of the suspensions. The sheets obtained with suspensions having a pH value 3, 5, 7, 9 (value of natural aqueous suspensions) 10 and 12, are all coherent and approximately of the same strength.

These different results allow of drawing a few conclusions relating to the internal mechanism of the formation of coherent sheets from suspensions of various mineral substances.

This formation results from the fibrous structure of the minerals contemplated. But the particles having such structures must moreover be very fine and of colloidal or pseudo-colloidal dimensions and capable of swelling in the aqueous support.

The swollen and stable particles are gradually deposited near each other, in proportion as the liquid support is eliminated by drying. Owing to their form and to the electric charges they must necessarily possess, they set themselves, by falling into alignment and by overlapping. As the drying proceeds, their volume is affected, since they were swollen and this modification prevents the internal stresses which would upset the equilibrium of the electric actions.

Finally, the particles are set side by side in overlapping relation and on the whole they constitute a mechanically stable and coherent structure.

The work can be effected on various smooth or treated supports, for instance powdered with talc or other materials, or parafined or oiled. Said supports can be movable for allowing endless sheets to be produced.

The sheets can be sized or not. The sizing can be effected by means of suitable substances such as rosin with or without alum, natural resins, synthetic resins, latex, waxy or resin emulsions, etc. These products can be introduced in the liquid phase of formation or during a subsequent treatment, either by a liquid process (solution, emulsion, wetting, atomisation, coating) or by a dry process (melting in the mass of a resin for instance).

The sizing imparts to the paper a certain resistance to water. If it is necessary to improve the latter, the dressing desired will be obtained by a chemical, physical or heat treatment. Chemically, the sheets can be treated, in course of production, either subsequently by suitable chemicals, such as tannins, salts, and in particular, chlorides, sulphates, acetates and nitrates of heavy metals, such as copper, cobalt, manganese, lead, chromium. By a physical process the surface can be metallized or a coating or treatment can be obtained by means of an emulsion or of a molten bath of waxes, paraffin. Finally, by a heat treatment the sheet can be heated, without, or better, with pressure. For instance, heating will be effected, with compression between calenders at 150° C with a pressure of 10 to 60 kgs/cm^2.

Some substances can be incorporated with the sheets to render them more flexible. Use will be made of known plasticizers such as glycol, glycerine and their derivatives, solvents and acetone esters, organic acetates.

The charges can be mineral charges and in powder form as in cellulose papers, or, on the contrary, formed by materials of particular structure and in particular fibrous or phyllitic of mineral origin (asbestos, micas, colloidal clays for instance) or vegetable origin (cotton waste, rags, paper pulps) or again animal origin (wool, silk).

The dyestuffs may be organic dyes, black pigments (lamp-black for instance), white pigments (titanium dioxide for instance) or coloured pigments (ultramarine, chrome-yellow).

For obtaining white sheets, certain synthetic or natural materials claimed are naturally very suitable. In other cases, for instance with blue crocidolite, or with green chrysotile, the product

is more or less highly coloured. Bleaching after crushing can be obtained by simply washing with a hot acid. Thus, for instance, the suspension will be boiled in a 25% solution of hydrochloric acid, then it will be rinsed by washing two or three times with water, each washing being followed by a decantation. The particles constituting the suspension will then be perfectly white.

The drying of the finished sheets will be effected by means known in the paper industry or by passage under lamps emitting infra-red rays near 12,000 Å. The finishing of the sheets can comprise all the usual operations, in particular, coatings, glazings, calenderings, etc.

A few brief examples are given hereinafter:

I. 10 parts by weight of fibrous amosite, finely crushed, are mixed with five parts by weight of short and carded fibres of chrysotile asbestos, one part of latex, four parts of titanium white and eighty parts of water: by deposition, a dull white sheet is obtained.

II. 10 parts by weight of fibrous or cork-like termolite, finely crushed, are mixed with five parts by weight of paper pulp, two parts of paraffin in emulsion and 83 parts of water, a somewhat translucent white sheet is obtained.

III. 15 parts by weight of blue crocidolite, finely crushed, are mixed with 1 part by weight of chrome-yellow; four parts of finely dispersed vinylic resin and 80 parts of water; a blue-green sheet is obtained which must be heated to 50° C. when drying, so as to distribute the resin and to impregnate the sheet therewith.

IV. 15 parts by weight of Canary (Corsica) asbestos, finely crushed, are mixed with 5 parts of the same substance, coarsely crushed, five parts of lamp-black and 75 parts of water; a flexible dull black sheet is obtained.

V. 15 parts by weight of Canary (Corsica) asbestos, finely crushed, are mixed with five parts of a 10% acetone solution of vinyl chloro-acetate resin and 80 parts of water; after calendering, a flexible dull grey impervious sheet, having a strength of 50 kgs/cm² is obtained.

VI. 10 parts by weight of finely crushed tremolite mixed with 5 parts of titanium white, 5 parts of a solution of vinylic resin and 80 parts of water give, after calendering, a flexible smooth white sheet having a strength of 40 kgs/cm² satisfactorily receiving the impression (printing, with a pad or by hand).

VII. 10 parts by weight of finely crushed tremolite are mixed with 5 parts of rayon waste cut into short and well dispersed fibres, 3 parts of zinc white and 2 parts of latex or of a dispersion of synthetic rubber. A flexible dull white sheet is obtained, having a strength of 30 kgs/cm², satisfactorily receiving all kinds of impressions.

VIII. 10 parts by weight of papyraceous mineral from Table (Savoy), finely crushed, mixed with 90 parts of water gives by simple deposition, flexible yellowish sheets, having a strength of 20 kgs/cm² before any sizing. After calendering in the hot state, said sheets become stronger; they lose their porosity and become capable of receiving all kinds of impressions.

IX. 10 parts by weight of papyraceous mineral from Table (Savoy), finely crushed, mixed with 5 parts of bentonite, 5 parts of asbestos fibrils and 80 parts of water, give flexible and dull sheets.

X. 15 parts of finely crushed papyraceous mineral from Table (Savoy) are bleached by washing with hydrochloric acid, then mixed with 5 parts of a vinylic synthetic resin in solution and 80 parts of water; a perfectly white sheet is obtained having a strength of 40 kgs/cm² satisfactorily receiving the impression after calendering.

It is obvious that, in these few examples, which are not given in a limiting sense, the proportions and the nature of the constituents can vary within wide limits according to the result to be obtained. The only common point is the final obtainment of a coherent sheet.

MAURICE DÉSIRÉ EMILE DÉRIBÉRÉ.

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Serial No. 474,321

ALIEN PROPERTY CUSTODIAN

METHOD FOR CENTRIFUGALLY CASTING THICKWALLED TUBES

Jacques Boucher, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed February 1, 1943

It is well known that it has not generally been possible heretofore to cast centrifugally thick-walled tubes by reason of the difficulties encountered in introducing into a tubular mould the incline of which is almost always small, a sufficient amount of molten metal without the latter passing again out of the mould during centrifugation through the inlet opening. It has been attempted, it is true, to make use of a slightly sloping mould wherein the loading ladle is first introduced and then gradually drawn outwardly during operation so as to distribute the metal throughout the length of the mold. It is thus possible to feed gradually the mould with molten metal with a view to providing, from the outer annular layers towards the inner layers, the successive and continuous solidification of the metal until a substantial thickness is reached, said thickness of wall being however limited by an inner diameter a little above the outer maximum diameter of the loading ladle. These prior arrangements are interesting insofar as it is possible to reduce the diameter of the tube through this gradual feeding of molten metal combined with the cooling of the end of the mould used for introducing the metal, which cooling produces at the end of operation the formation of a solid tubular extension which prevents the molten metal from being projected outwardly when, the load being complete, the centrifugation is almost at an end.

My invention allows for the first time the centrifugal obtention of very thick tubes of small inner diameter in moulds of the type adapted to rock round a transverse horizontal axis. Such moulds are of current use for centrifugally casting normal tubes which do not show any considerable thickness; to this day these moulds have been used in order that they may be filled more easily in a sloping position by means of an external loading ladle which may be a stationary ladle after which they are lowered slowly into their horizontal position while they are set rotating round their longitudinal axis so that they may assume the speed required for centrifugation and a uniform distribution of the metal throughout the length of the mould only when they have returned into their said horizontal position. My invention makes use of such moulds in view of a novel method of casting which differs from that used heretofore with such moulds inasmuch as, the mould being as before entirely loaded in its sloping position generally at a small incline which may however reach nearly 90° in certain cases, the volume of liquid metal introduced is greated than the free capacity of the mould, considered bounded by the horizontal plane passing through the lower edge of the inlet opening in the final horizontal or substantially horizontal position occupied by the mould at the end of the solidification process; the mould being thus filled is gradually returned into its final position while the centrifugation is proceeded with, said centrifugation ending after the mould has returned into its final substantially horizontal position. This centrifugation is always performed with the mould rotating at a speed which is sufficiently high for preventing at any moment the liquid metal, remaining near the axis of the mould inside the tube in formation and which does not momentarily take part in the centrifugation, from forming an amount sufficient to reach the level of the inlet opening. Only the end of the centrifugation is performed in a substantially horizontal position so that the inner wall of the tube nearing complete solidification may assume if required a perfectly cylindrical shape; at this moment substantially all the metal still in the liquid state is centrifugally driven to form the last inner layers of the tube. Consequently the volume of liquid metal originally introduced in the mould may be greater than the free capacity of the mould considered underneath the level of inlet opening for the final position of the mould; in other words, although it is impossible, for the final substantially horizontal position of the mould, to attempt to fill even half the mould lest the metal should pass immediately out of the mould, yet the slow lowering of the mould in the method according to invention allows the loading of the mould with a volume substantially greater than half its total volume. To this end it is necessary that to each successive angle of incline of the mould submitted to centrifugation should correspond a certain amount of metal carried round by centrifugation and on the point of becoming solid, said amount being sufficient for the remainder of the liquid load to be insufficient in amount to fill the inside of tube being formed above a level passing underneath the inlet opening for the angle of incline considered.

The invention will be more readily understood by reference to a particular application mentioned solely by way of example, of the method according to the invention adapted to the obtention of a tube having an outer diameter of 150 mm, an inner diameter of 50 mm and a length of 6 m. For this application, it is possible to use a mould the incline of which is originally at 10° above horizontal, the mould being loaded while it

remains at this incline and while it rotates at 800 r. p. m. from the very beginning of its being loaded. The duration of this operation of loading with molten metal is 40 seconds after which the mould is returned to horizontal position, the duration of this return movement being 3 minutes. The centrifugation at the same speed of rotation continues during said return movement and lasts for still 10 minutes more, the mould being returned to horizontal, the speed of revolution remaining the same or falling gradually as the cooling progresses.

Numerous modifications may be brought to the execution of the method according to invention. In particular, the centrifugally cast tubes may show a cylindrical or conical outer shape which may also differ from that of a surface of revolution particularly if it is grooved or fluted. The outer surface of the tubes may include portions which for certain angular or annular zones have diameters different from those of other zones. Similarly one or both ends of the tube may be closed or again the inner surface of the tube may be given a parabolic shape as disclosed in the copending application Ser. No. 388,131 filed on April 11, 1941, of which the present application is a continuation in part. According to other modifications, the loading process may end either a little before or a little after the beginning of the return movement of the mold to horizontal.

JACQUES BOUCHER.

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ALIEN PROPERTY CUSTODIAN

DEVICES FOR LOWERING A LOAD

Pierre Jean-Marie Théodore Allard, Chantilly, France; vested in the Alien Property Custodian

Application filed February 1, 1943

The present invention relates to a device intended to facilitate the lowering of the load in hoisting and manipulating apparatus which comprise a movable carriage rolling on a horizontal or inclined rolling track or carrying cable and connected to a reversible winch by a cable. The object of the invention is to improve the operation of such manipulating apparatus and more particularly to allow the length of the rolling track or carrying cable to be greatly increased, whilst avoiding at the same time the production of an excessive sagging of the cable when it is slackened in order to lower the load.

According to the invention, the movable carriage comprises an auxiliary electric motor which is automatically set in action when the carriage reaches a position in which the load must be lowered and when at the same time the winch rotates in the direction for lowering the load, said auxiliary motor being arranged to exert on the hoisting cable an additional force in the lowering direction, owing to which the formation of the prejudicial sag of said cable is avoided, even if its horizontal span is very great, and the regular lowering of the load is always ensured.

The other features and advantages of the invention will be more clearly understood by referring to the accompanying drawings which illustrate by way of example and not in a limiting sense, a preferred form of construction.

In said drawing,

Fig. 1 diagrammatically illustrates a hoisting and manipulating apparatus to which the invention is applied:

Fig. 2 illustrates in elevation the arrangement of the movable carriage;

Fig. 3 is a detail view of the pulley of said carriage.

In Fig. 1 can be seen a movable carriage 1 which travels between the positions A and B on a rolling track 2. In the example considered, a horizontal rolling track is illustrated, constituted by a rigid beam, but the invention can also apply to apparatus the rolling tracks of which are inclined or constituted by carrying cables for instance or by other means.

The hoisting cable 4 one end of which supports the load of any kind whatever, passes over the pulley 3 of the carriage 1, shown in its extreme position A, defined by the terminal abutment 15, then reaches the fixed pulley 16, arranged near the other extreme position B, and continues towards a suitable winch 21 not shown. The successive displacements of the carriage 1 between the positions A and B are imparted by any means whatever which do not form part of the present invention and which have not been illustrated either.

Supposing the load hung from the cable 4 when the carriage is in position A, is to be lowered, the winch is caused to rotate in the direction for unwinding said cable, and it will be seen that, under certain conditions, especially if the load is not heavy, a prejudicial sagging of the horizontal part of cable 4 may be produced; the operation can then become uncertain or irregular.

To avoid these difficulties, the movable carriage is devised as illustrated in Figs. 2 and 3. Said carriage, supported by the rolling wheels 14, comprises a small auxiliary motor 6 which can drive the pulley 3 about its shaft 17 in the direction for lowering the load (as shown by the arrow) by means of the belt or chain 5 or of any other suitable transmission or reducing device. Said motor is supplied with current by the wires 7 connected to a set of brushes or rubbing parts 8 secured on the carriage and coming in contact with corresponding fixed contact bars 9, secured to the rolling track 2 through the medium of suitable insulators 19 and 20 at the place or places where the load is to be lowered; the contact bars 9 are fed by the electric line 18, connected in its turn to the corresponding contact-pieces of the controller or reversing switch which controls the operation of the winch 21.

The pulley 3 driven by the motor 6 can be smooth or provided with impressions allowing the utilisation of calibrated chains; it can also be devised to use a composite hoisting strand constituted by a cable or a chain: a roller 11 supported by the levers 10 pivoted at 13, exerts under the action of the weight 12 or of other means such as springs, a slight pressure on the cable 4, at the place where the latter reaches the pulley 3 during the lowering of the load, so that the cable will show sufficient adherence and be driven by the pulley without slipping.

To illustrate the operation of the device according to the invention, it will be assumed that the carriage 1 supporting the load moves, under the action of suitable means, from position B towards position A where it is stopped by the abutment 15. It will also be assumed that it is in position A that the load must be lowered. The arrangement of the electric connections is such that the contact bars 9 are under tension only when the electric motor of the winch 21 is connected in a manner which makes it rotate in the direction for which it unwinds the cable 4. Under these conditions, as soon as the brushes 8 reach the bars 9, the motor 6 is supplied with

current and it causes the pulley **3** to rotate in the direction of the arrow whilst taking up the slack of the cable **4** and ensuring the regular lowering of the load.

The speed of motor **6** and the transmission system are preferably so chosen that the circumferential speed of pulley **3** at its point of contact with cable **4** is substantially the same as the speed of unwinding the cable from the winch.

When the load is deposited and as soon as the lowering movement of the winch is stopped by cutting off the supply of current to its motor, the auxiliary motor **6** also stops.

When the winch **21** is then caused to rotate in the direction for winding up the cable, the bars **9** are no longer fed with current, and the auxiliary motor which no longer receives current, is idly driven by pulley **3**; a free wheel or like device can also be provided for preventing this driving of the motor **6**.

It is to be understood that the arrangement described by way of example can be modified without departing thereby from the scope of the present invention.

PIERRE JEAN-MARIE THÉODORE ALLARD.

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BY A. P. C.

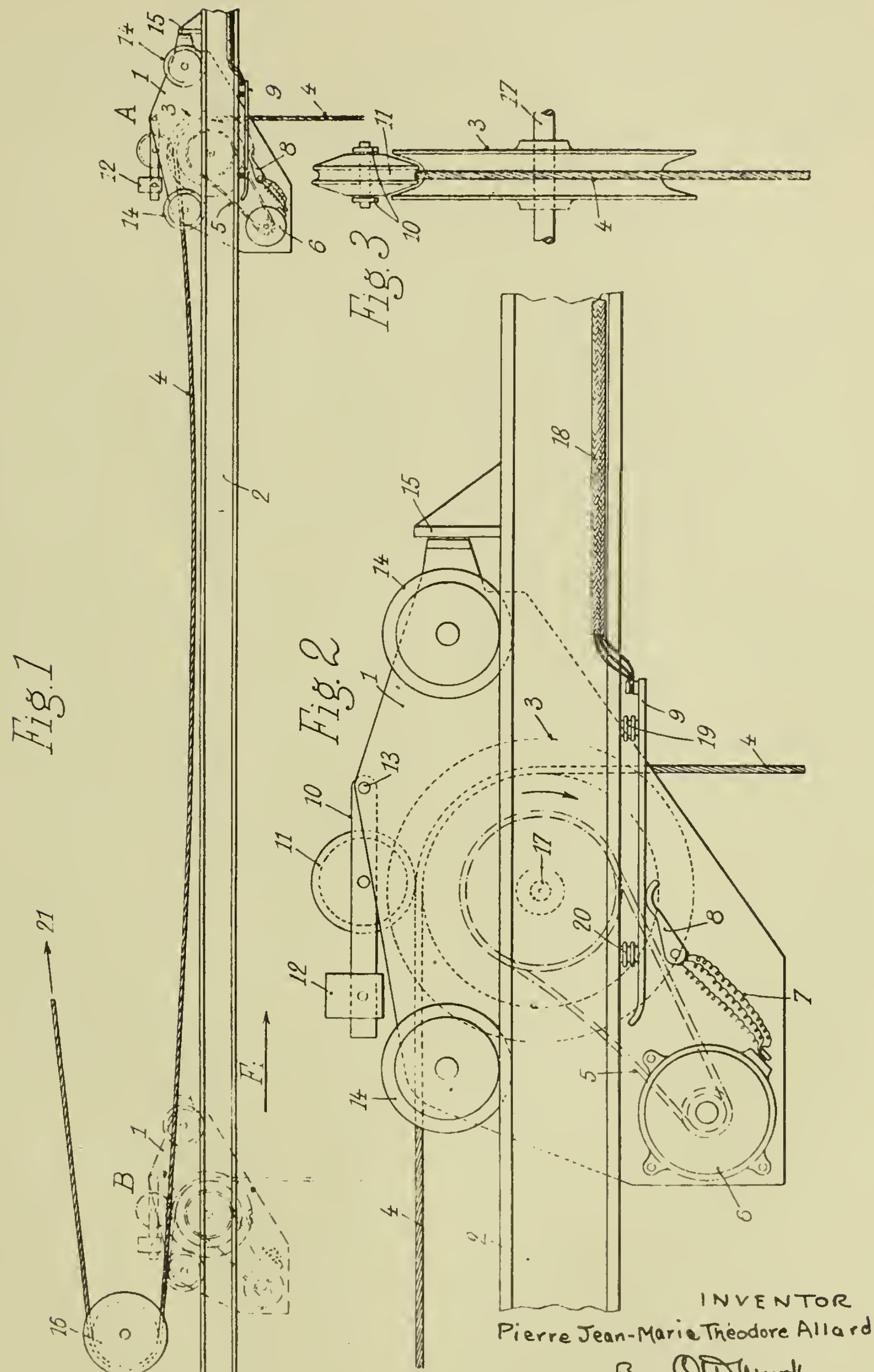
P. J-M. T. ALLARD

DEVICES FOR LOWERING A LOAD

Filed Feb. 1, 1943

Serial No.

474,325



INVENTOR

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his ATT'Y

Published July 13, 1943 | Serial No. 474,326

ALIEN PROPERTY CUSTODIAN

COUNTERWEIGHT CONTROL SYSTEMS FOR LIFTING DEVICE CRABS

Pierre Jean-Marie Theodore Allard, Chantilly, France; vested in the Alien Property Custodian

Application filed February 1, 1943

My invention relates to lifting devices of the type including a horizontal or slightly inclined guideway along which a crab is adapted to run, to which crab is hung an automatic grab or the like goods-handling device, said crab advancing in a given direction under the action of a counterweight adapted to return the crab towards the discharging position. The invention is more particularly applicable to the apparatuses of the type described in my prior specification Ser. No. 282,817, filed on July 4, 1939.

Said invention has for its object a counterweight control system for returning the crab towards the discharging position and adapted to stop the crab at a predetermined position and adapted to stop the crab at a predetermined point of its return travel. To this end, according to the invention, an adjustably positioned stop is arranged in the path of the counterweight so as to balance the action of the latter and to stop the crab at the desired point.

In the case of an automatic grab of the type described in the above mentioned prior specification, this stopping of the crab produces at the same moment the automatic emptying of the grab through the slack given to the lifting cable to which the grab is suspended.

Other features of the invention will appear from the following description, reference being made to the accompanying drawing in which:

Fig. 1 is a diagrammatic view of a first form of execution of the invention.

Fig. 2 shows diagrammatically a modified control for the stops, constituted by an electromagnetic relay.

Fig. 3 shows an arrangement including a single stop adjustably positioned as to height.

Fig. 4 shows diagrammatically an automatic device for giving the stop a reciprocating vertical motion at a uniform or variable speed so as to produce a regular or irregular displacement of the point at which the grab or the like part empties its contents between the two extreme points corresponding to the extremities of the path allowed for the adjustable stop.

Reverting to the drawings, 1 designates an automatic grab, secured to the end of a hoisting cable 2 passing over a return pulley 3 carried by a carriage or crab 4 the rollers 5 of which run along a horizontal or slightly inclined rail 6. The opening ring 7 is suspended to a cable arranged in the same longitudinal vertical plane as the cable 2 and secured to a lever 8 pivoted at 9 to the crab 4 and provided with a counterweight or a spring 10 urging the brake shoe 36 into contact with the rail or guideway 6.

When in position for loading over the axis AB, the crab abuts against the stop 11 under the action of the weight of the grab suspended to the cable 2.

The crab is urged backwards by the return system including a cable 12 passing over a return pulley 13 and to the end of which is suspended a driving counterweight 14.

In the form of execution of Fig. 1, a rotary rod 15 is arranged parallel to the path of the counterweight 14 and is provided at different heights with projecting fingers 16, 17, 18 angularly shifted one with reference to the others by suitable angles. The rod 15 carries also a lever 19 whereby it is possible to give said rod the desired angular position. The lowermost stop may be constituted by a stationary part 20.

According to the angular position given to the rod 15, the counterweight is arrested by either of the stops constituted by a finger 16, 17 or 18 or the part 20, so as to stop the grab in the corresponding emptying position as shown diagrammatically at *a*, *b*, *c* and *d*.

In the form of execution illustrated in Fig. 2, 21 designates one of the stops distributed at different heights along the path of the counterweight 16. This stop is carried by a lever 22 adapted to pivot round a stationary axis 23 and urged in one direction by a spring 24 and in the opposite direction by the armature 25 of a coil 26 inserted in the circuit of a current supply 27 with a switch 28. Normally, the switch 28 being open, the spring 24 urges the lever 22 into the position shown in dot and dash lines, for which the stop 21 is no longer in the path of the counterweight 14. When the switch 28 is closed, the coil 26 attracts its armature 25 which brings the stop 21 back into the path of the counterweight.

In the example shown in Fig. 3, the stop 29 which stands constantly in the path of the counterweight 14 is constituted by a plate adjustably positioned as to height. To this end, the plate 29 is secured to a screw 30, screwed inside a nut 31 held horizontally stationary by any suitable means while a guiding rod 32 cooperates with the plate 29 in order to prevent the screw from rotating. By rotating the nut 31 by means of a crank, a hand wheel, a small motor or the like, there is provided a vertical displacement of the plate 29.

In the modification according to Fig. 4, the plate 29 or a contact moving integrally therewith may engage the contacts 33, 33*a* of a reversing switch 34 inserted in the circuit of a motor 35

controlling the rotation of the nut **31**. As the motor is constantly rotating either in one direction or in the other according to the position of the reversing switch **34**, the plate **29** moves at a uniform speed between the two contacts **33**, **33***a*, alternatingly upwards and downwards. Consequently the point where the counterweight is stopped during its successive travels varies for each travel of the grab in a regular manner. Thus the grab is emptied to form a uniform heap between two extreme emptying points (say *a* and *b*) the position of which depends on that of the contacts **33**, **33***a*.

Of course, the invention is by no means limited to the examples of execution described hereinabove, which are given solely by way of example and it is obvious that many mechanical, electrical, hydraulic or the like devices may be readily imagined for varying the position of the stops for the counterweight **14**, either at will or automatically.

PIERRE JEAN-MARIE
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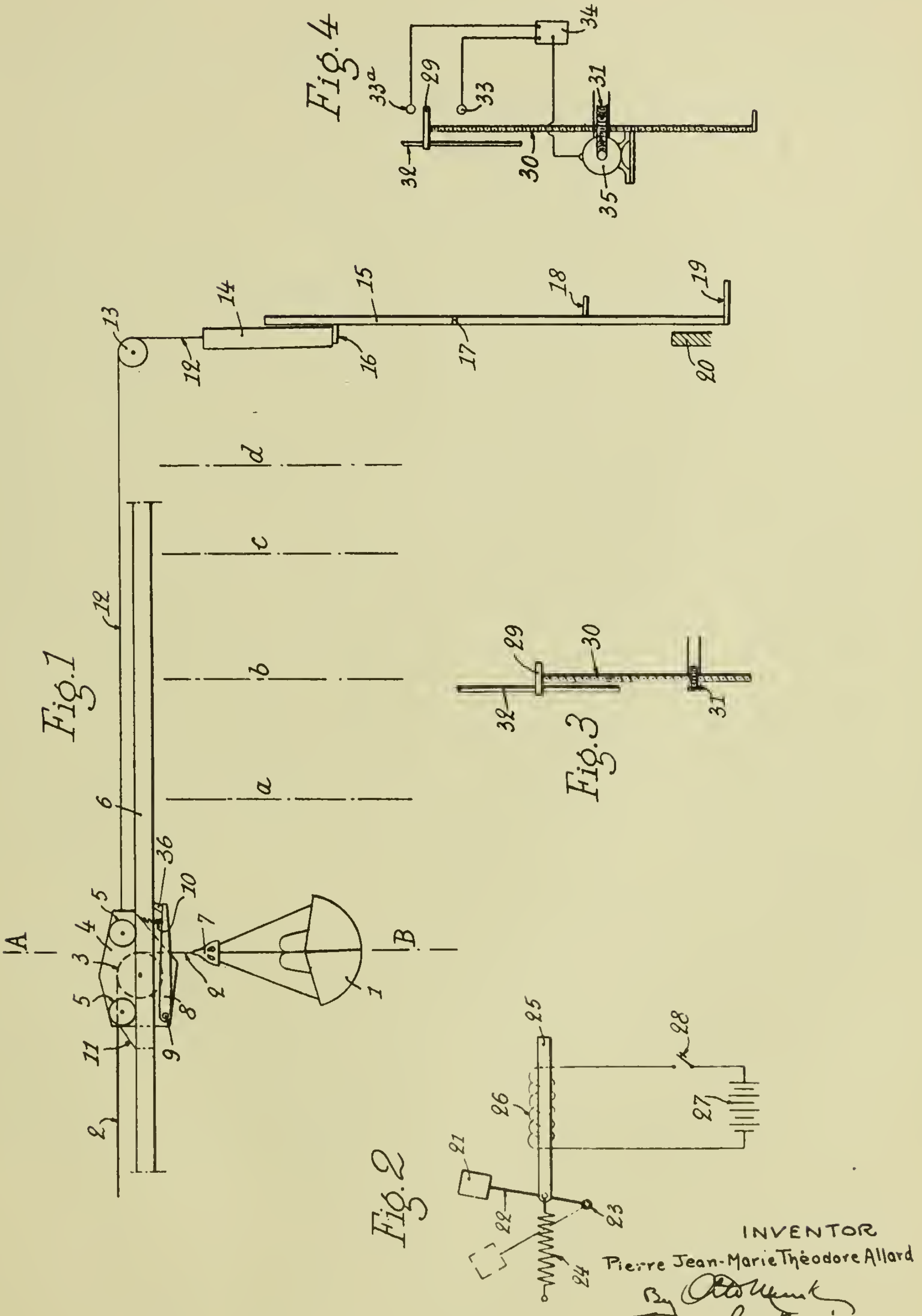

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ALIEN PROPERTY CUSTODIAN

GRABS USED FOR BORING

Pierre Jean-Marie Theodore Allard, Chantilly, France; vested in the Alien Property Custodian

Application filed February 1, 1943

The present invention relates to improvements in grabs used for boring in order to improve the operation thereof.

In the use of such grabs of known type, it frequently happens that they become placed askew in the hole, resulting in risks of wedging and deviation of the bore-hole. Moreover, when such a grab operates with a single cable, its engaging and disengaging device becomes frequently clogged, either owing to the fact that the grab is placed askew, or because when moving up or down its upper part scrapes the hole.

According to the present invention, the above inconveniences and difficulties are avoided and the operation is appreciably improved by the fact that the grab comprises, at its upper part, a guiding device constituted by radial projections of rounded shape inscribed in a diameter corresponding to that of the scoops of the grab, and arranged to guide the upper part of the grab substantially coaxially inside the bore-hole.

The other features and advantages of the invention are set forth in the following description with reference to the accompanying drawing which diagrammatically illustrates by way of example and not in a limiting sense, an embodiment of the invention. In said drawing:

Fig. 1 indicates the faulty position of a grab unprovided with the means according to the invention;

Fig. 2 illustrates an improved grab;

Fig. 3 is a plan view of the grab of Fig. 2, on an enlarged scale.

In Fig. 1 will be seen a grab 1 comprising a suitable automatic engaging and disengaging device 4 and scoops 7, operating in the bore-hole 6. Said grab being placed askew, it may become wedged or cause the bore-hole to deviate. On the other hand, as its part 4 is in contact with the walls of the bore-hole which may be constituted of loose material, the latter clog up the head of the grab and hinder the satisfactory operation thereof.

According to Figs. 2 and 3, the grab is provided with a guiding device constituted by shaped sheet metal plates 2 of rounded profile which are inscribed in the diameter D corresponding to the diameter of the scoops of the grab, so as to make up for the difference existing between the latter and the reduced width of the body of the grab proper.

The ribs 5 provided on the sheet metal plates 2 can be obtained by any means; they can be constituted by plates secured thereto which offer the advantage that they can be replaced when they are worn by the nearly continual friction thereof against the walls of the bore-hole.

Owing to this device, it will be seen that the head of the grab can no longer come in contact with said walls. On the other hand, the form of construction illustrated leaves, as shown in Fig. 3, very large passages between the grab and the walls of the bore-hole, so that the device according to the invention does not brake the downward movement of the grab, even if the latter is to be lowered into a bore-hole full of water, which frequently happens. Preferably as shown the radial projections are separated from each other by wide intervals forming vertical passages. Finally, it is to be noted that during the rising or lowering of the grab, the latter can no longer become wedged nor rock, so that the head can in no case come in contact with the walls of the bore-hole and that the engaging and disengaging device 4 is consequently protected against shocks.

It is to be understood that the embodiment illustrated is not limiting and that it can be modified without departing thereby from the scope of the present invention.

PIERRE JEAN-MARIE THEODORE ALLARD.

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GRABS USED FOR BORING
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Fig. 1

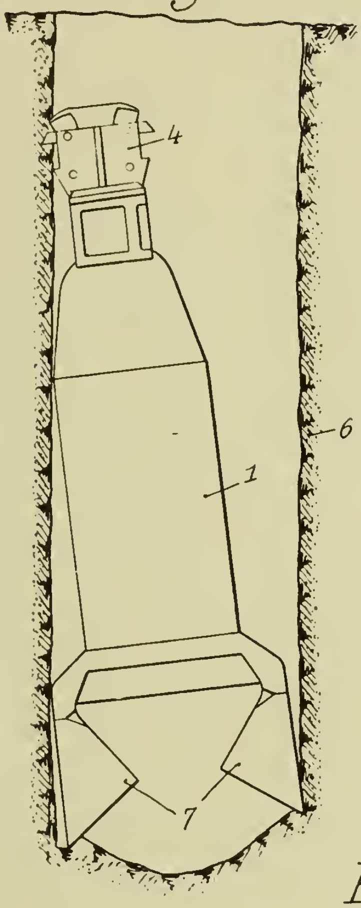


Fig. 2

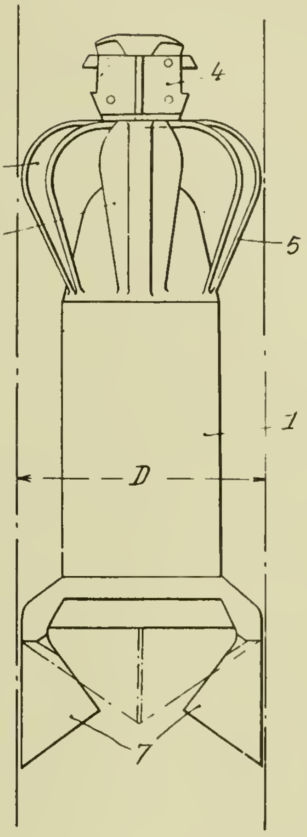
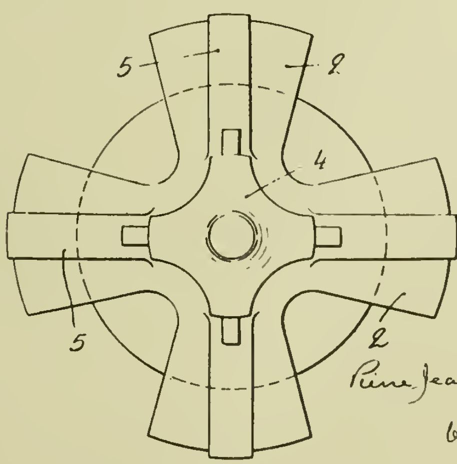


Fig. 3



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Published July 13, 1943

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ALIEN PROPERTY CUSTODIAN

PACKING BAGS

René Faillot, Paris, France; vested in the Alien Property Custodian

Application filed February 1, 1943

In certain paper packing bags, and chiefly those of great capacity, whose bottom is formed by the sewing of the two adjacent edges of the flattened tubular bag, the sewing is effected upon a paper band which covers, while bordering them for a certain height, the edges of the bag to be sewed.

However, for the majority of bags of this known class, the sewing thread, on the outside, is always in contact with the open air, and the holes for passing the thread are visible.

Known bags of this class are employed, in which the seam is simply impregnated with paraffin, which in principle, stops up the holes used for the thread. But the layer of paraffin is thin, and the heat or other causes may rapidly destroy or damage the film of paraffin.

The external moisture may not only attack the thread and thus destroy it, but it may chiefly penetrate into the interior of the bag at a somewhat rapid rate by passing through the sewing holes, and will damage the product contained in the bag. This is especially to be feared when the bag has been subjected to a prolonged load, for instance in a pile of bags.

The present invention relates to a packing bag of this class, but this is improved, owing to the fact that the sewing thread is protected against all outer effects, and eventually against inner effects, while entirely preventing the moisture from passing through the sewing holes and thus reaching the product in the bag.

In the accompanying drawing, which is given by way of example:

Fig. 1 is a vertical cross-section of a sewed bottom of an improved bag.

Fig. 2 is a modification.

The known paper bags of great capacity usually consist of several superposed sheets of paper 1. These sheets are assembled in the form of a tubular flat sleeve, and the adjacent edges of the bottom are covered or bordered with a band 2 of paper or like material, and a seam 3 of thread or wire is formed in such way as to secure the band 2 to the edges of the bag.

According to the present invention, the sewing thread 3 is protected by a thick layer 4 of a product which remains always somewhat pasty and is particularly unaffected by moisture, and this waterproofing layer 4 is covered by a band 5 of paper, cloth or other flexible material which aids in holding the protecting layer 4 in place.

This layer preferably consists of tar, bitumen, or asphalt obtained from petroleum or coal, said products adhering well to the paper and being very hard to dry.

This waterproofing layer will perfectly and definitely close up the thread holes, and it also protects the thread. The contents of the bag are thus kept closely.

The invention has further the advantage of allowing a lengthening of the stitches, thus obtaining a saving of the thread in use. The waterproofing layer and the paper band which cover this seam will greatly strengthen the bottom of the bag.

It is possible, as shown in Fig. 2, to also apply in the interior, at the junction of the two edges of the bottom of the bag, a layer 6 of a protecting product (asphalt, bitumen, tar, or the like) which is covered, or not, with a band of paper 7 or other product, which serves to protect the sewing thread 3 from the action of the material contained in the bag.

Like advantages can be obtained if the edges of the bag are joined together by metal claps or clamps instead of by sewing.

The same arrangements are applicable to seams for bags, whatever be the number and the position of such seams. Obviously, such arrangements are applicable to bags consisting of any other material than paper, or of combined material such as paper, textile fabrics, etc.

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PACKING BAGS
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Fig. 1

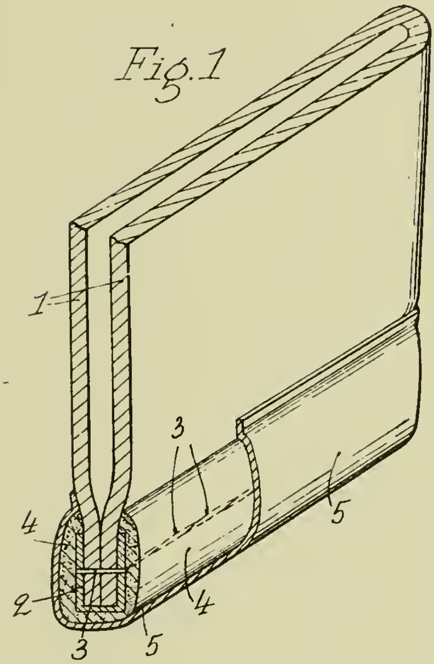
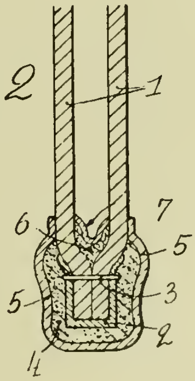


Fig. 2



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his ATTY.

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ALIEN PROPERTY CUSTODIAN

CENTRIFUGAL CASTINGS

Pierre Boissou, Pamiers, France; vested in the Alien Property Custodian

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The present invention relates to the casting by centrifugation into rotary moulds, of hollow members such as tubes or pipes.

The long and thin tubes used up to the present are generally obtained by distorting solid ingots, in the cold state, or more often in the hot state. Very numerous processes are known for effecting said distortions. All said processes have serious inconveniences: they are complicated, necessitate powerful plants, comprise successive steps, requiring a considerable amount of labour and involving a very high consumption of energy. Moreover, they sometimes necessitate successively reheating the metal several times, and the products thus obtained do not escape all the difficulties of manufacture and all the imperfections of execution inherent to rolling. In particular, the presence of solder can limit the conditions of use of certain welded tubes.

Finally, all these tubes can only be obtained in well defined shades of metal. For instance, in the case of steel, certain shades of steel may happen to be set aside, whatever may be the advantages they might offer, either because they are industrially unsuitable for rolling, or because they cannot be welded, or because they have an important shrinkage and that they are apt to present shrinkage holes, or for any other similar reason.

On the other hand, it is known that the casting of similar members, of very great length and reduced cross-section or of small thickness, has encountered very great difficulties as regards numerous materials and several metals. In particular, the casting by centrifugation of long and thin tubular members has only been solved up to now for certain metals or alloys relatively easy to melt and having great fluidity.

It has not been possible for instance to use centrifugal casting methods consisting in successively injecting the molten metal at each point of the rotating mould by means of a casting conduit moving longitudinally within said mould, for metals or alloys which are difficult to melt: in fact, the important and unavoidable cooling of said metals along the casting conduit would necessitate, in order that they should reach the mould at a sufficient temperature, a too important superheating which would involve difficulties in the melting, transport, oxidation or the like, of said metals.

On the other hand, the processes consisting in massively casting these same metals into a rotating mould are also inapplicable: in fact, the rapid solidification of said metals would not leave them the time to become distributed, along the mould, in the form of a uniform layer, especially if long and thin members are to be produced.

The present invention has for object a new centrifugal casting method allowing to obtain pipes or other long and thin tubular members, which can be applied to all metals, alloys or other fusible materials, even to those which are difficult to raise to a temperature much higher than their melting temperature, and which owing to their low fluidity reserve, do not lend themselves, industrially, to casting by the known methods.

Another object of the invention is to provide rotating devices for carrying out the process according to the invention and allowing the manufacture of cast articles of substantially tubular shape in very varied metals and in particular in steel.

The other objects of the invention will become apparent from the following description.

The method according to the present invention consists in progressively casting the molten metal at one end of the rotating mould, by injecting it into said mould through one of its end walls, in choosing and controlling the speed of injection and the speed of rotation of the mould in function of the temperature and of the physical characteristics of the metal, of those of the mould as well as the dimensions of the member to be manufactured, so as to determine the rapid solidification of the successive portions of said metal by contact with the walls of the mould, the entire period of casting being thus much longer than the time necessary for the solidification of each of the portions of said metal.

In the casting method according to the invention, the consecutive cooling, solidification and localization of the metal therefore begin from the inlet end of the mould (side where the casting is effected) and then proceed towards the opposite end, the molten metal injected at every instant proceeding, without appreciably cooling, at the internal surface of the metal previously injected, already solidified, but still very hot, until it reaches the free part of the mould and by contact with which it cools and solidifies in its turn.

The surface separating the molten metal and the solidified metal thus moves towards the end of the mould, without distorting, and assuming at every instant a flared shape which promotes the advance of the molten metal, as will be set forth hereinafter.

According to other features of the invention and for facilitating the advance of the molten

metal within the mould, after its injection into the latter, forces are exerted thereon having a longitudinal component directed towards the end of the mould, or, when it is injected into the mould, an initial impulse is imparted thereto directed in the same direction, or both the above mentioned forces and impulse are exerted thereon.

According to another feature of the invention, use is made of a mould closed at its end and comprising at its inlet end an orifice of reduced dimension, allowing solely the injection of the metal and the evacuation of the gases contained in the mould or dissolved in the metal, so as to prevent the entrance of ambient air, the internal cooling of the member and the formation, in the midst of the latter, of a solidification surface proceeding from the interior towards the exterior.

Such a rotating mould, metallic or not, comprises means for exerting on the molten metal to be cast after its injection into the mould, forces the longitudinal resultant of which is directed towards the end of the mould opposite the casting end, or for imparting thereto, when it is injected, an impulse directed in the same direction.

Said means can be constituted for instance, by a mould having a diverging profile or by a mould having an axis inclined relatively to the horizontal, or again by a distributor comprising a container for molten metal and a calibrated nozzle under pressure opening in alignment with the orifice of the mould, or also by a rotating divergent distributor placed in front of the mould, or finally by the combination of several of the above mentioned means.

Other features and advantages of the present invention will be set forth in the following description.

In the accompanying drawings given by way of example only:

Fig. 1 is a longitudinal section of a centrifugal casting device according to the invention, illustrated at the beginning of the casting;

Fig. 2 is a cross-section of said device, made according to line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic view, on an enlarged scale, in longitudinal section of the same device, showing the flared shape of the surface separating the molten metal and the solidified metal, as well as the propelling action exerted by said surface, by its rotation, on the molten metal.

Fig. 4 is a view in longitudinal section, at the end of the casting, of the device illustrated in Figs. 1 and 2.

Fig. 5 is a view in longitudinal section of a modification comprising the use of an inclined cylindrical mould.

Fig. 6 shows a longitudinal section of another embodiment of the invention comprising the use of a truncated mould exerting an increased propelling action on the molten metal.

Fig. 7 is a partial diagrammatic view, in longitudinal section, of a modification of the casting device comprising the use of a divergent distributing injector intended to increase the initial speed of the metal or other molten material when it is injected in the mould, this plant being illustrated at the beginning of the casting.

Fig. 8 is a cross sectional view of a different form of distributor.

Fig. 9 is a longitudinal section of another modification of the casting device in which the member to be cast itself constitutes a divergent distributor.

Fig. 10 is a longitudinal section of a cylindrical pipe.

Figs. 11 and 12 illustrate by way of example, a tubular article capable of being manufactured according to the invention.

According to the examples illustrated in Figs. 1 to 4, the plant for centrifugal casting according to the invention comprises a rotating mould **1** (Fig. 1) movable about a horizontal axis X—X. The mould is supported and rotatably driven by rollers **2** and **3** rotating about axes Y—Y, and capable of being rotatably driven in their turn by a driving device, not shown. The mould **1** is held stationary longitudinally by external flanges **4** which take a bearing laterally on the rollers **3**.

The body of the mould is constituted by a metal frame **5** provided with a refractory lining **6** made of moulding sand compressed and stoved; holes **7** are formed through the frame **5** to allow the evacuation of the gases produced in the refractory lining at the time of casting.

The frame **5** is terminated at its ends by truncated bearings **8** and **9** on which are secured, by means of keys **10**, the end walls of the mould; said end walls are themselves constituted by a metallic cup **11** which supports a refractory lining **12**; one of the end walls is provided with a central orifice **13** for the injection of the molten metal.

This injection orifice opens in alignment with a nozzle **14** arranged at the bottom of a casting pot **15**, said nozzle and its casting pot being constituted by a pisé or any other refractory material.

The casting, according to the method of the invention, is effected in the following manner: the mould **1** is set in rotation and the molten metal **16** is rapidly poured into the casting pot; the metal escapes through the nozzle **14** in the form of a jet **17** with a speed which is dependent on the height of metal above said nozzle; at the same time, the casting pot **15** continues to be fed so as to maintain constant the level of the metal and, consequently, the flow from the nozzle.

The metal enters the mould **1** and comes into contact with the internal wall **18** of the latter in the very vicinity of the inlet end of the mould. It is drawn along in the rotary movement of the mould and it is applied by centrifugal force against the internal surface **13**.

The layer of metal **19** (Fig. 3) being for a moment the most forward in the mould **1** and encountering no obstacle to its flow at the front, continually tends under the action of centrifugal force, to spread out on a certain length AB and take the shape of a ring, the inner radius DE of which increases from the rear A towards the front B, thus constituting a tubular element the free inner surface **20** of which is flared towards the front. As said advanced molten layer of decreasing thickness becomes localized by the very contact of the cold or relatively cold mould, it solidifies and rapidly comes to rest in this position thus affording for the following molten layer **21** a solid truncated casing.

Each particle P of the layer **21** is thus subjected to a centrifugal force PC at right angles to the axis X—X. If the mass of the particle P is designated by m, its distance PH to the axis X—X by r and the angular speed of rotation of the mould by ω, the value of the centrifugal force is given by the known formula:

$$PC = m\omega^2.r$$

This force can be decomposed into its two components PN at right angles to the solidification surface of the ring and which applies the metal against said surface, and PL parallel to the meridian to said surface. The latter causes the metal to move towards the free part of the mould where it solidifies in its turn in the same conditions and in the same shape as the metal of the preceding layer, as it is intended in its turn to play the same useful transitory part for the benefit of the following layer.

The phenomenon thus finds very advantageously in itself the means of sustaining its own evolution according to a stable and lasting regime, as the molten layers which thus propagate forwardly constantly leave place behind them for the molten metal which continually penetrates into the mould during the casting operation.

Said metal thus proceeds (Fig. 4) in the form of a liquid cylinder **22** within the solid cylinder **23** formed by the metal already set. This solid cylinder is still very hot and, by contact therewith, the portions of molten metal successively injected practically maintain their temperature, they remain fluid, thus flowing through a metal tube the length of which progressively increases, and successively come into contact with the free internal and cold wall **18** of the mould against which they solidify in their turn.

Consequently, the placing in position of the metal proceeds step by step practically indefinitely. This phenomenon ceases only when the casting is stopped or when the advancing metal encounters the end wall **24** of the mould. The injection of the metal must have ceased at this precise moment as the casting is then normally terminated. It then suffices to remove the cast member from its mould.

According to an important feature of the method of the invention, the layer of metal solidified at each point rapidly reaches a thickness approximating the final desired thickness; the circulation of the molten metal within the metal cylinder already solidified prevents the latter from cooling and its thickness from increasing appreciably during all the casting period. The solidification therefore takes place as a whole, according to a longitudinal process.

On the contrary, in the known processes, said solidification takes place, in particular after the molten metal has been distributed on the entire length or on an important part of the length of the mould; the thickness of the solidified metal increases simultaneously at each point and the solidification thus takes place, as a whole, according to a radial process.

The final thickness of the tubes cast according to the method of the present invention depends on numerous factors and, in the first place, on the cooling action of the mould.

It may be noted that, all things being moreover equal, the layer of solidified metal is so much the thinner: As the mould has a smaller thermal conductivity; as it is hotter; as it is thinner; as it has a lower specific heat; and as, consequently, it heats up more rapidly.

For instance, the thickness of the solidified metal is greater in an entirely metallic mould than in a mould lined with refractory material.

On the other hand, the features and physical state of the cast metal also intervene in the solidification process, the solidified layer being so much the thinner—as the metal has a higher specific heat; as it is hotter and of a more fluid nature.

Finally, the thickness of the solidified metal depends, to a certain extent, on the duration of the casting, conditioned in its turn to the outflow of the nozzle; a more rapid casting limits the quantity of heat yielded to the mould by the metal, and consequently, the thickness of the solidified layer.

In any case, an important feature of the invention resides in the combined use of a mould having definite thermal characteristics and for instance uniform throughout its length, and a calibrated nozzle, or other device distributing the molten metal at a constant flow, in order to maintain constant, throughout the length of the mould, the thermal conditions of the solidification and to thus obtain members of uniform thickness.

When the mould is very long, the temperature of the molten metal may slightly diminish from the inlet end to the end of the mould and the conditions of solidification be slightly modified thereby. But, in this case, it remains possible to maintain the thickness of the members uniform throughout their length by varying the flow during casting or by varying the thermal characteristics of the mould, for instance, its thickness at various distances from its inlet end.

More generally, the invention allows of obtaining at every point the desired thickness of metal by simultaneously controlling the flow of metal at every instant of the casting and the thermal characteristics at every point of the mould.

Owing to the new manner in which the molten metal is distributed in the mould without its temperature and its fluidity diminishing appreciably, and to the possibility of acting on the various above mentioned factors, the invention allows said metal to be injected at a very great distance from the casting orifice and to thus obtain thin and long tubular members even with metals which it is very difficult and expensive to raise to a temperature higher than the melting temperature, which therefore have only a small temperature margin and the fluidity of which diminishes very rapidly as soon as their temperature lowers approximately to melting temperature.

According to the particular example of Fig. 10, the steel tube, cast by centrifugation according to the invention, is a long and thin tube for pipelines. Its outer surface and its inner surface can be cylindrical and concentric or conical and can comprise bosses, flutes, grooves, etc., as well as the members for assembling them and fitting them together.

The length l of said tubes can reach for instance 6 or 8 meters or even more. Their internal diameter d can vary for instance from a few centimeters, 2 cm. for instance, to several decimeters, and even if need be exceed one meter.

The thickness e of the walls of said tubes, which varies in function of the diameter, of the pressure of the fluid it is intended to transport and of various other factors, can lower to 4 or 5 and even to 2 millimeters or reach, for instance 15 to 20 millimeters for tubes of medium or of large diameter subjected to an important internal pressure or external stresses. For steel tubes the length of which exceeds one meter, it is possible to obtain, owing to the means of the invention, a wall thickness lower than 1% and even than 0,5% of the length, which is impossible with known casting processes.

Fig. 5 shows the same tube in course of manufacture by centifugal casting in a rotating mould

movable about an axis X—X inclined relatively to the horizontal. The mould is constituted by a metallic frame 5 internally provided with a refractory lining 6 made of moulding sand compressed and stoved, holes 7 being formed through the frame 5 for allowing the evacuation of the gases produced in the refractory lining at the time of casting. The frame 5 is terminated at its ends by truncated bearings 8 and 9 on which are secured, by means of keys 10, two end walls constituted by a metallic cup 11 which supports a refractory lining 12; the highest end wall has a central orifice 13 for the injection of the molten metal. This injection orifice opens in alignment with a nozzle 14 arranged at the bottom of a casting pot 15; said nozzle and its casting pot are constituted by a pisé or any other refractory material.

The mould is supported and rotatably driven by rollers *16a* and *17a* rotating about axes Y—Y, and rotatably driven in their turn by a driving device, not shown. The mould 1 is held stationary longitudinally by outer flanges *18a* which take a bearing laterally on the rollers *17a*.

In this modification the axis X—X of the mould is inclined relatively to the horizontal to the extent of an angle α. It results therefrom that the action PG of gravity, which is exerted on every particle P of the molten metal contained in the mould 1 and which is applied by centrifugal force against its internal wall 19, can be decomposed into two components, one,

$$PN=PG.\cos\alpha$$

at right angles to the axis X—X and the other,

$$PL=PG.\sin\alpha$$

parallel to said axis and directed towards the lower part 27 of the mould. Each particle of molten metal is thus drawn along towards the lower part of the mould until, when it comes into contact with the free wall 19 of the mould, it cools, solidifies and comes to rest in its turn.

According to a modification illustrated in Figs. 11 to 12, the tubular member 23 made of steel cast by centrifugation is intended to serve as an electric line support. Its inner surface 24 has the shape of a truncated cone. Its outer surface comprises three parts: a truncated part 25 located on the side of larger diameter and intended to be embedded in the ground, a central part 26 also of general truncated shape, and intended to be placed at man's height, and an end part 27, also truncated, longer than the preceding parts and constituting the top part of the post.

The central part 26 can be provided with external flutes 28 the cross section of which diminishes towards the small diameter of the post.

Fig. 6 illustrates the same tube during manufacture by centrifugal casting in a rotating mould 29. Said mould is similar to that above described: it is essentially composed of a metallic frame 30, an inner refractory lining 31 and two end walls 32 and 33 secured by keys 10. The end wall 33 placed on the side of small diameter of the mould is perforated by a central orifice 34 for the injection of the molten steel. The frame 30 rests, by its rolling tracks 35 and 36 on rollers 37 and 38 through the medium of which it can be rotatably driven about the horizontal axis X—X, by means of a driving device, not shown. The refractory lining 31 has an inner surface 39 complementary to the outer surface of tubular post 23; it can comprise flutes 40 intended to form the flutes 28 of the tubular post 23.

The injection orifice 34 opens in alignment with the nozzle 41 arranged at the base of the casting pot 42.

Owing to this method of construction of the moulds, each particle P of molten metal contained in a mould and rotatably drawn along is subjected to a centrifugal force PC which has a longitudinal component PL directed towards the bottom of the mould. This component is exerted on the molten metal throughout the length of the mould; it compensates the friction which would have the effect of progressively braking the flow of the metal and allows the latter to maintain its speed of advance on an increased distance. Owing to this arrangement much longer members can thus be obtained.

Calculation shows and experience confirms that a very small conicity suffices for exerting on the metal a very powerful action.

This action can be for instance calculated, in the case of a rotating mould having an average radius of 0.15 meter, a speed of rotation of 1.500 revolutions per minute and a very small conicity such that each of its generatrices forms an angle of 1/1000 with the axis of rotation.

In this case a longitudinal acceleration component: $Pc=3.7$ m/sec/sec, is obtained which is very important and which imparts great facility to the molten metal to proceed within the mould: this advance takes place in the same conditions as if the metal flowed freely; under the action of gravity, on a fixed inclined plane having a slope of

$$3.7{:}9.81=0.377$$

corresponding to an angle of inclination of 22 degrees.

It must be added that this very small conicity is easily obtained, for instance, in the case of sand moulds by giving the corresponding slightly conical shape to the metallic pattern used when clamping the mould. This clearance moreover allows the easy disengagement of said pattern after the preparation of said sand moulds; it has furthermore the advantage of facilitating the longitudinal shrinkage of the cast members and it renders their removal from the mould particularly easy after solidification.

Owing to the use of an inclined or truncated mould as above described, it is possible, for instance, to extend the length of the members obtained to 6 to 10 meters and even more, in the case of tubes having an internal diameter of several centimeters or of a few decimeters and a wall thickness of 2 to 15 millimeters.

It may be advantageous, for tubes of this length, to increase the initial speed of the metal at its inlet into the useful part of the mould.

This result is obtained for instance, according to the invention, by securing at the end of the mould 5 (Fig. 7) a rotating distributor 48, having an inner surface 49 of truncated shape widening from the orifice 50 admitting the metal up to its junction 51 with the mould 5. Said distributor is rendered rigid with the mould by screws 52 and it also rotates about the axis X—X.

The operation of said distributor is as follows: the molten metal 53 injected into the distributor through the orifice 50 comes into contact with the inner surface 49 of the distributor by which it is rotatably driven. Each particle P of the metal is thus subjected to a centrifugal force PC at right angles to the axis X—X.

If the mass of the particle P is designated by m, its distance PH to the axis X—X by r, and the

angular speed of rotation of the distributor 48 by ω, the value of the centrifugal force PC is given by the known formula:

$$PC=m.\omega^2.r$$

By designating by β the angle formed by each generatrix of the truncated distributor 48 with the axis X—X, and by decomposing the force PC into its two components: PN at right angles to the wall of the distributor and PF directed according to a generatrix of said wall, it will be seen that the distributor according to the invention has the effect of exerting on each part of the metal a force one of the components of which:

$$PN=m.\omega^2.r.\cos\beta$$

is perpendicular to the wall 49 of the distributor and applies the metal against said wall, and the second component of which

$$PF=m.\omega^2.r.\sin\beta$$

parallel to the generatrix of the truncated cone passing through P has for result to promote the movement of the metal towards the mould.

This latter force, which is proportional to the second power of the speed of rotation, increases as the radius r, that is to say very gradually, in proportion as the metal moves from the inlet of the distributor towards the mould and without causing any perturbation in its flow.

Owing to the invention, a very high longitudinal speed can thus be imparted to the metal at the moment it enters the mould, which allows it, before it loses its temperature and fluidity, to cover a longer distance within said mould: the possibility of producing members of increased length results therefrom.

The drawing along of the molten metal and the operation of the distributor can be improved by giving to the latter a rough internal surface. According to the embodiment illustrated in Fig. 8, this result is obtained by providing the inner surface 54 of the distributor 48 with longitudinal ribs 55 which become impressed in the molten metal and accelerate its centrifugal rotation.

The divergent rotating distributor can, according to the invention, be devised in various manners. Fig. 9 illustrates an embodiment in which the rotating mould is externally provided on the side of the casting orifice 13 with a series of cooling ribs 56. On the other hand, the thickness of the refractory lining 59 is greatly reduced straight below said ribs, so that, in this part of the mould, the cooling of the latter and consequently, that of the molten metal are considerably increased.

Said device operates as follows: at the beginning of the casting an important amount of metal 57 solidifies at the inlet to the mould and the inner surface 58 of said solidified portion assumes a truncated shape which acts as a divergent distributor on the molten metal subsequently injected into the mould.

If the presence of this reinforced portion is not desired in the cast member, it suffices to section it after removal from the mould, according to the plane Z—Z for obtaining a tubular element having the desired internal cylindrical shape.

It is very important to emphasize the simplicity of the new method for manufacturing said members: it allows, in fact, of directly obtaining finished members starting from molten metal and by avoiding any other metallurgical or shaping operation. A considerable reduction of the expenses of the plant, labour, fuel, and exploitation as well as an appreciable diminution of the metal losses result therefrom, relatively to the other processes.

Moreover, the invention has the great advantage of being indistinctly applicable to all metals or other fusible bodies, and in particular to those which do not lend themselves to other shaping processes.

By eliminating the use of a long casting conduit penetrating into the mould, the invention can be moreover applied to the utilisation of very small moulds and thus allows of manufacturing members of a smaller diameter than the other known centrifugal casting methods.

The method according to the invention has finally the great advantage, relatively to the other known methods, of producing members soundly constituted. Thus in the casting of metals in general, the formation of shrinkage holes in the thickness of the members is only avoided provided that the solidification of their walls takes place and proceeds according to a single working face; shrinkage holes are unavoidably produced each time the molten metal solidifies and shrinks in a closed space limited by two or more solidification faces which advance to meet each other. In the manufacture of long and thin tubular members and in particular of thin tubes, a solidification face is compulsorily formed at the outer surface of the member, owing to the cooling action of the mould. It is therefore essential to prevent the formation of another solidification face starting from the inner surface of the members. This result is obtained owing to the casting method and to the shape of the mould according to the invention.

In fact, the metal already stationary in the mould is protected from any cooling action from within the mould, by the layer of hotter molten metal which flows and is constantly renewed within the member. On the other hand, the outer cold air is prevented from entering the mould by closing the latter at both its ends by two end walls, one only of the end walls being perforated with an orifice as reduced as possible for the injection of the molten metal.

According to the embodiments illustrated in Figs. 1, 4, 5, 6 and 9, the orifice 13 or 34 for the injection of the molten metal opens opposite the nozzle 14 or 41 through which spurts the molten metal 17 or 43. Said orifice can also be enlarged to allow the introduction of the nozzle 14 into the mould or into the distributor 48 as shown in Fig. 7, this latter arrangement having the advantage of avoiding any projection of molten metal outside the mould. In both cases, the annular clearance existing between the orifice 13 on the one hand, and, on the other hand, the jet of molten metal 17 or the outside of the nozzle 14, must be reduced to the minimum.

At the beginning of casting, the air contained in the mould suddenly expanding very rapidly escapes outside. It is moreover known that molten metals contain a considerable quantity of dissolved gases or gases in the combined state. Said gases spontaneously evolve upon cooling and centrifugation appreciably accelerates the elimination of the gases from said metals in the molten or pasty state. The hot gases which, after the air escapes from a centrifugal mould such as above described, are for the greater part combustible gases; they ignite and burn at the outlet of the hole of the casting cup; it has been found that the flame persists for a relatively long time after the solidification of the metal as ter-

minated, which allows of affirming that the external atmosphere does not at all penetrate into the tube or other member in course of solidification.

It results therefrom that the inner wall of said tube is sheltered from any cooling action exerted by the ambient air; it can only cool by contact with the external concentric layers which, in their turn, cool by contact with the centrifugal mould or chill. In other words, the calories of the metal flow radially in a single direction, that according to which centrifugal force acts, and the metal solidifies according to a single face at right angles to said direction. It results therefrom that no portion of the molten metal solidifies in a closed space limited by two or more solidification faces advancing to meet each other. Owing to this very advantageous feature of the invention, it has been proved that the tubes cast by centrifugation in accordance with the method and/or by means of the devices above described, have walls rigorously free from shrinkage holes.

The present invention therefore allows not only of obtaining by simple casting, that is to say in very advantageous economical conditions, thin and long tubular members, but also of avoiding the various defects which are frequent in the members obtained by other methods. Thus, the unevennesses in wall thickness are avoided by the centrifugal casting, and the longitudinal unevennesses by the method of distributing the metal along the mould.

Furthermore, the solid or gaseous inclusions are also driven out by the extremely intense action of centrifugal force, and the shrinkage holes eliminated by the particular cooling method directed exclusively from the exterior towards the interior of the member. Finally, the members obtained are perfectly isotropic at every point.

The long and thin tubes and other tubular members made of cast metal obtained according to the invention present numerous other advantages relatively to similar members obtained up to now by known ingot casting, forging, punching, rolling, drawing or other processes.

Furthermore, they can be constituted by any steel or other metal or alloy whatever, without it being necessary that the latter should satisfy the conditions of malleability, rolling, weldability, limited shrinkage, etc. This feature considerably extends the possibilities of the art and allows of using, for instance, new varieties of steel or other ferrous alloys which, up to the present, have not been practically used notwithstanding their particular advantages, either because they are industrially unsuitable for rolling, or because they are difficultly weldable, or because they have an important shrinkage, or for any other reason.

For instance, the invention is applicable to tubes for pipe-lines embedded in the ground, made of steel having 13% of chromium. As this steel is only slightly oxidizable, the tubes can be given a smaller thickness solely conditioned by the mechanical stresses to which said tubes are subjected owing to the internal pressure of the fluid conveyed or to external overstresses.

The regularity of these members is as remarkable as the quality of the metal constituting their walls; in fact, the unevennesses in wall thickness are avoided by centrifugal casting and the longitudinal unevennesses by the method of distributing the metal along the mould.

Finally, the members according to the invention are perfectly isotropic at all their points: they do not have the fibrous structure of members obtained by rolling: this feature is particularly advantageous for members subjected to corrosion, in particular, for the tubes of underground pipe-lines, as a fibrous structure promotes, as is known, the corrosion of the metal.

In addition to the embodiments illustrated in Figs. 10 and 11, the members manufactured can be cylindrical on a portion of their length and conical on another portion, or more generally can have an outer shape which flares towards the larger end of the mould. They can be externally provided with projections which are not flared provided that the inner surface of the member does not appreciably depart from the shape of the cylinder or truncated cone, and provided the mould is destroyed for allowing the removal of the member after each casting operation.

The cross section of the members can be circular or on the contrary have any external polygonal or like shape, or can be provided with flutes or grooves. The shape of said cross section can moreover vary along the mould.

The pipe-line tubes made of centrifugal steel can also have a widened end serving to constitute a socket joint: said widened end being provided only outside the member, the inside of the latter remaining cylindrical at the time of casting to be subsequently subjected to a suitable shaping or, again, the interior of the socket joint being also formed at the time of casting by means of a fitting core secured at one end of the mould, as known per se.

Finally, the length, thickness and internal diameter of the tubes and other tubular members can vary within wide limits; the values above indicated being given by way of example and not in a limiting sense. Said members can be used such as they issue from the mould or, on the contrary, can be subjected to any subsequent transformation.

Of course the invention is not limited to the embodiments illustrated and described which have been chosen only by way of example.

It can thus be applied not only to steel, but also to any metal, alloy or other fusible material capable of passing from a molten or pasty state to a solid state, whether this change of condition takes place upon cooling, as described, or for any other physical, chemical or like reason.

The mould can be destroyed at each operation, or on the contrary can be permanent, for instance, entirely metallic. It can have any other shape, for instance a cylindrical shape on a portion of its length and truncated on another portion, or the shape of a paraboloid of revolution.

The surface of the mould can be provided with counter-taper parts which do not affect the general shape of the mould, provided said parts are destroyed or taken to pieces after each casting for allowing the removal of the members.

The cross section of the mould can be circular as illustrated, or on the contrary, it can have any fluted polygonal or like shape; the shape of the cross section can moreover vary along the mould. For instance, in the casting of pipes, one end of the mould can be widened for forming the socket joint of the member.

Use can also be made of a mould inclined towards the casting orifice, but sufficiently flared for the longitudinal component of centrifugal force to be greater than the longitudinal com-

ponent, directed in reverse direction, of gravity. Reversely, use can also be made of a mould flared towards the casting orifice but sufficiently inclined in the reverse direction for the longitudinal component of gravity to be greater than that of centrifugal force.

The orifice for the injection of the metal can be arranged exactly at the center of the end wall of the mould or, in particular, in the case of a mould of large diameter, it can be out of center and placed for instance in the vicinity of the lower generatrix of the mould; in this case, a fixed cheek member can be used for obturating as completely as possible, the end of the mould and thus prevent, according to the invention, the entrance of the cold ambient air into said mould.

The divergent rotating distributor made of metal or of refractory material, can be secured in position and rotatably driven independently of the mould, at a speed equal to or different from that of the latter. The profile of said distributor can be truncated as shown, or can have any other general divergent shape, such as that of a sector of a paraboloid of revolution. Its surface can be smooth, rough, striated or groooved.

On the other hand, not only can a constant impulse be imparted to the metal or constant forces exerted thereon during the entire casting period, but said impulse and/or said forces can be varied during the operation, for instance at the end of the casting, either by modifying the speed of rotation or the inclination of the mould, or by changing the level of the molten metal in the casting pot.

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Fig. 1

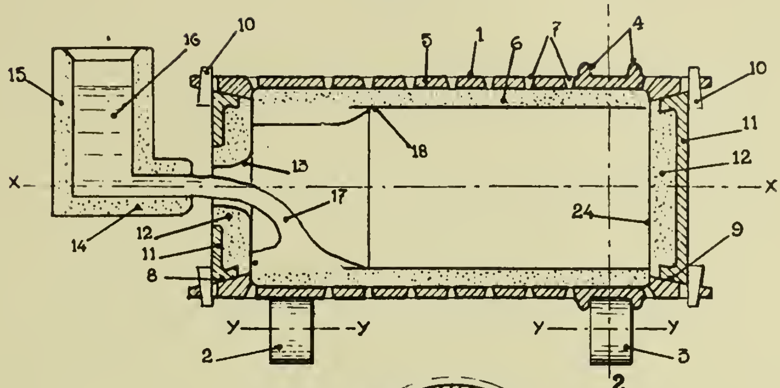

Fig 2

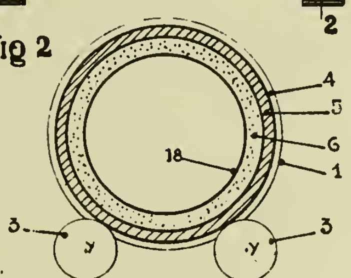

Fig 3

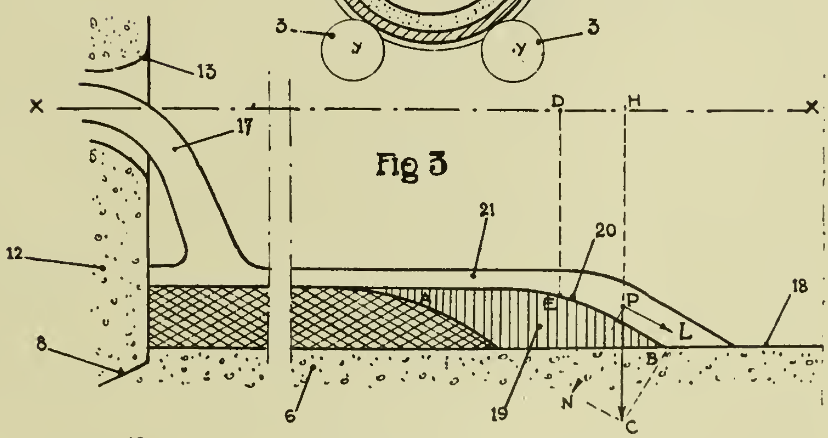

Fig 4

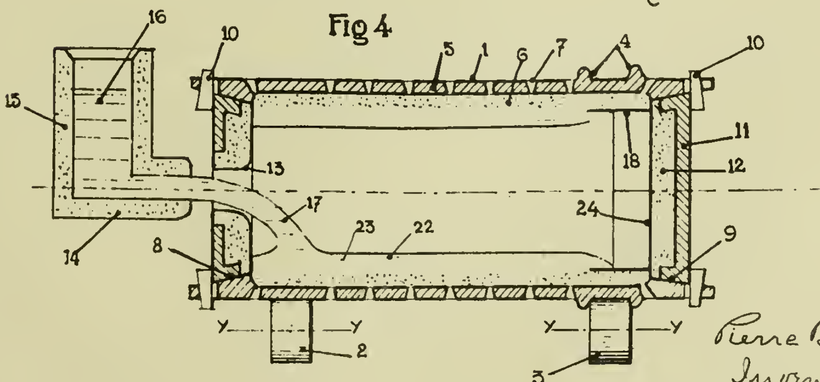

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Fig 10

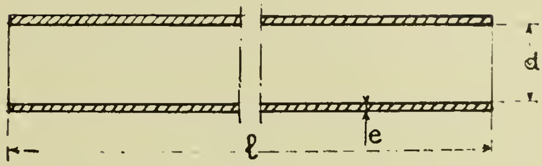

Fig.5

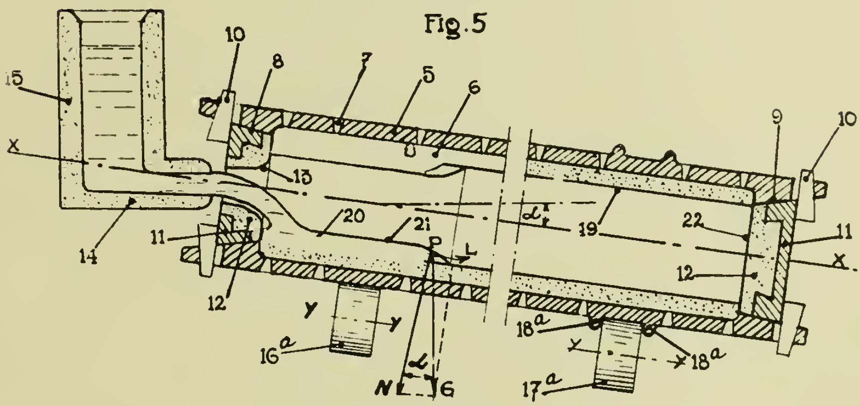

Fig.11

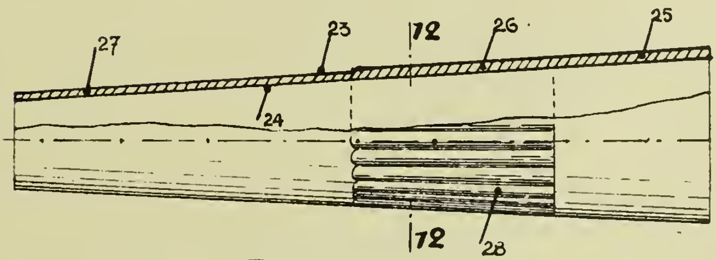

Fig.12

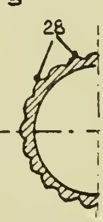

Fig.6

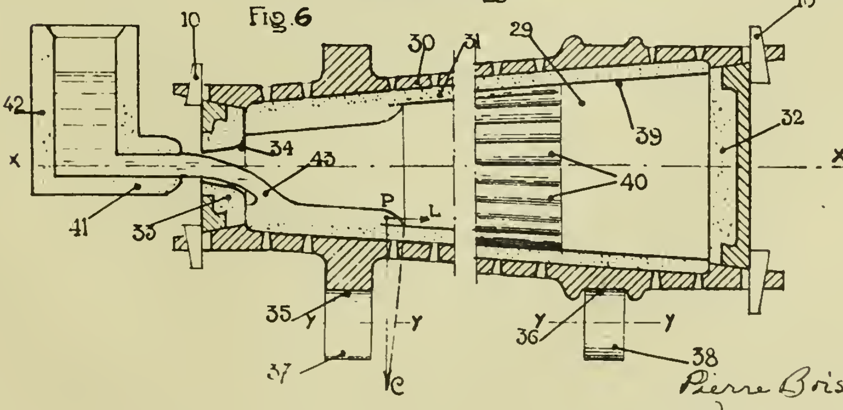

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Fig. 7

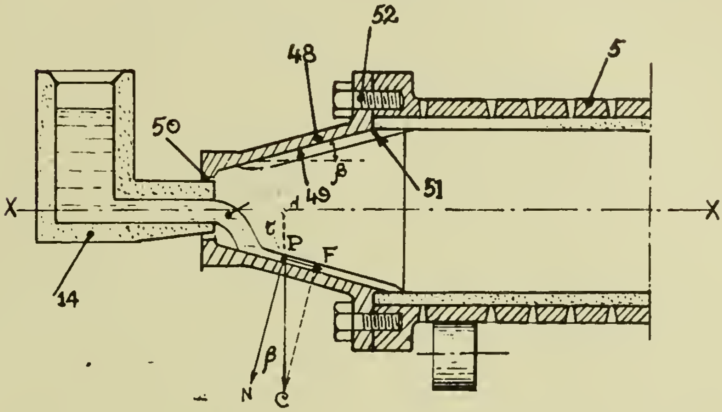


Fig. 8

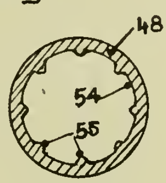
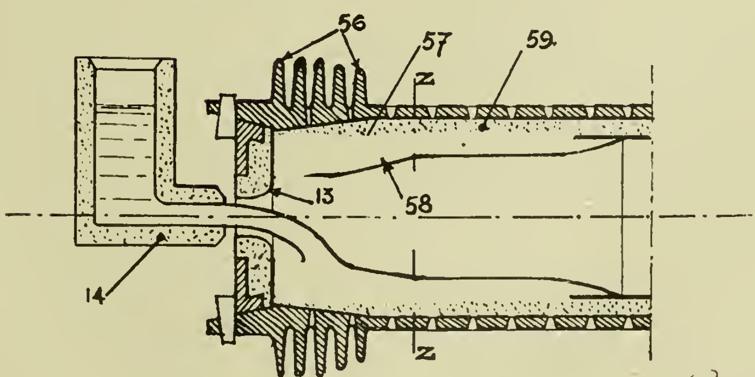


Fig. 9



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Serial No. 476,022

ALIEN PROPERTY CUSTODIAN

ELECTRIC APPARATUS FORMING PARTS OF INDICATING, MEASURING, REGULATING AND STEERING SYSTEMS

Albert Patin, Berlin, Germany; vested in the Alien Property Custodian

Application filed February 15, 1943

My invention relates to improvements in electric apparatus forming parts of indicating, measuring, regulating and steering systems, and more particularly in devices having the function of a spring and tending to hold a movable element or elements in an initial position and adapted when the said element or elements have been moved to return the same into said initial position. My device may be used for example in measuring systems and relays, and generally in sensitive systems, and in such systems the device has the function to return a movable element or elements into initial position when the said element or elements have been brought out of the said initial position by a force acting thereon. One of the objects of the improvements is to provide an apparatus which is constant in operation and independent of outer influences, and which therefore is adapted to set the said element or elements exactly in the same initial position. In this respect my improved apparatus is distinguished from springs now in use which are subject to fatiguing and to influences by temperature, and which therefore must be constantly under control by an attendant. Another object of the improvements is to provide an apparatus of the class indicated which may be readily varied as to its directing force even while the system is in service. With these and other objects in view my improved apparatus comprises electromagnetic means including means to generate a magnetic field and a conductor adapted to be energized by electric current and when thus energized to produce a magnetic field cooperating with the aforesaid magnetic field, the said means to produce a magnetic field and conductor being movable relatively to each other under the influence of the force resulting from the said fields, current regulating means operatively connected with said electromagnetic means and movable in accordance with the relative displacement of said field generating means and conductor, a source of electric energy, and a circuit connecting said conductor, current regulating means and source of electric energy in such a way that when said conductor and field generating means are moved relatively to each other by an outer force, a current flows through the said conductor and generates a magnetic field, the said fields tending to return the conductor and field generating means into initial relative position, the said device forming a part of a system such as has been referred to above.

For the purpose of explaining the invention several examples embodying the same have been shown in the accompanying drawings, in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings

Fig. 1 is a diagrammatical sectional elevation showing a system acting as a dynamometer,

Fig. 2 is a side elevation of Fig. 1,

Fig. 3 is a diagram showing the electrical circuits of the apparatus shown in Figs. 1 and 2,

Fig. 4 is a diagram illustrating the operation of the apparatus shown in Figs. 1 to 3,

Fig. 5 is a diagrammatical plan view showing a modification,

Fig. 6 is a fragmentary sectional elevation taken on the line 6—6 of Fig. 5,

Fig. 7 is a diagram showing the circuits of a system including the apparatus shown in Figs. 5 and 6, and

Fig. 8 is a diagram showing the electrical circuits of a system similar to that shown in Fig. 7.

In Figs. 1 to 3 my improved apparatus has been shown embodied in a system for measuring forces or gravities. As shown, the apparatus comprises a permanent magnet 1 supported on a base plate 2, a soft iron core 3 located between the poles N—S of the said magnet and fixed to a plate 4 secured to the magnet 1 and providing annular gaps 5 therewith, and an electric coil 6 rotatably mounted coaxially of the core 3. The said coil is mounted by means of trunnions 7 in suitable bearings provided in the core 3. To the coil 6 a hand 9 is secured which plays on scale marks 10 made on a segmental plate 15 fixed to the magnet 1. Further, an arm 11 is secured to the said coil and the said arm carries a fine and exceedingly resilient spring contact 12 which is in sliding engagement with a coil 13 of bare and closely wound wire placed on a carrier 14 mounted on the plate 4.

One end of the coil 6 is connected by a lead 16 with the spring contact 12. The opposite end of the coil is connected with a terminal 18 secured to and insulated from the plate 4 so as to permit free movement of the coil. As shown the connection consists of a flexible wire 17.

To the coil 6 a segmental disk 31 is secured which has a tension element 27 trained on its circumference. To the said tension element the force to be measured is applied which has been represented in Fig. 1 by a weighted body 19.

The resistance coil 13 is included in a circuit 20 including a source of electric energy such as a battery 21 (Fig. 3). The terminal 18 is connected by a lead 22 with a resistance 23 and an ammeter 24, and the said lead 22 is connected to

position of the system. Further, with a definite total number of ampere windings of the coils 53 and 54, the intial voltage between the contact springs 65 and 66 is dependent only on the resistance 75, and it is independent of the resistances 59 and 60 and the accurate winding thereof.

In the construction shown in Figs. 5 to 7 the electrical connection of the relay is made substantially in the form of a Wheatstone system. In Fig. 8 I have shown a modification in which a compensating connection of other type is provided. The construction of the relay is the same as that described with reference to Figs. 5 to 7, and the same reference characters have been used to indicate corresponding parts. Therefore, the construction and the electrical circuit will be understood though various parts such as the electric motor, the rudder and the gyroscope have been entirely omitted or represented only by some of their parts. Between the poles N and S of the permanent magnet 50 the coils 53 and 54 and a coil 92 are mounted on a common carrier, and the contact 65 slides on the resistance 59. The coil 53 is included in a circuit 76, 77 with the resistance 47 and the slidable contact 46 controlled by the gyroscope (not shown), and the said circuit includes the regulatable resistance 79. The coil 54 is connected by the leads 83, 85 with the resistance 82, the contact 81 sliding thereon, and the regulatable resistance 84. In lieu of the coil 52 shown in Figs. 5 to 7 the coil 92 is provided. The terminals of the said coil are connected by leads 93 with the ends of the resistance 59. The middle of the coil 92 is connected by a lead 95 with the contact 65, and the said lead includes the battery 94 which has the function of the battery 74. The circuit 39 of the armature winding of the electric motor 33 is connected to the end terminals of the resistance 59.

In the median position of the slide contact 65 the potential difference at the ends of the resistance 59 is zero, and no current is supplied to the motor 33. But when the said contact has been shifted on the resistance to the right or left, the said potential difference is either positive or negative, and accordingly the motor 33 is operated for turning the rudder to the right or left.

The operation of the system is as follows:

In the normal position of the parts shown in Fig. 8 the contact 65 engages the resistance 59 at its middle, and therefore currents of equal intensity flow from the contact 65 through both branches of the resistance 59 and through the upper and lower branches of the coil 92. The total number of ampere windings of the coil 92 is zero, and therefore the said coil does not generate a magnetic field. If, however, the set of coils 92, 53 and 54 is turned clockwise or anticlockwise in the manner described with reference to Figs. 5 to 7, the contact 65 is shifted on the resistance wire 59 to the right or left, and thereby the currents flowing through the upper and lower branches of the coil 92 are different, and therefore the said coil produces a magnetic field. The windings and other connections are such that the magnetic field thus produced tends to return the set of coils into the zero position shown in the figure, whether the set of coils is turned clockwise or anticlockwise.

The function of the coils 53 and 54 and the parts connected therewith is the same as that of the corresponding parts shown in Figs. 5 to 7. Therefore the operation of the whole system will be understood without further explanation.

ALBERT PATIN.

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BY A. P. C.	Filed Feb. 15, 1943	4 Sheets-Sheet 1

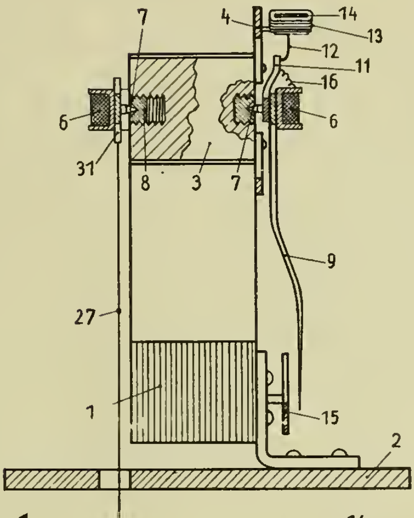

Fig.1

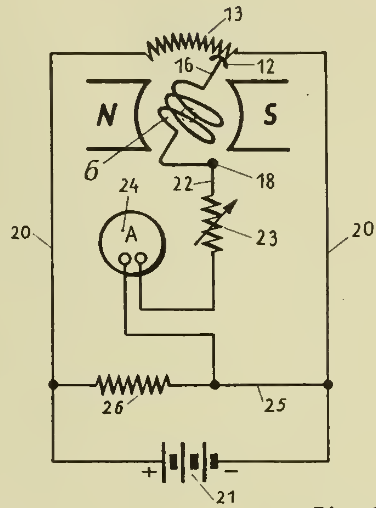

Fig.3

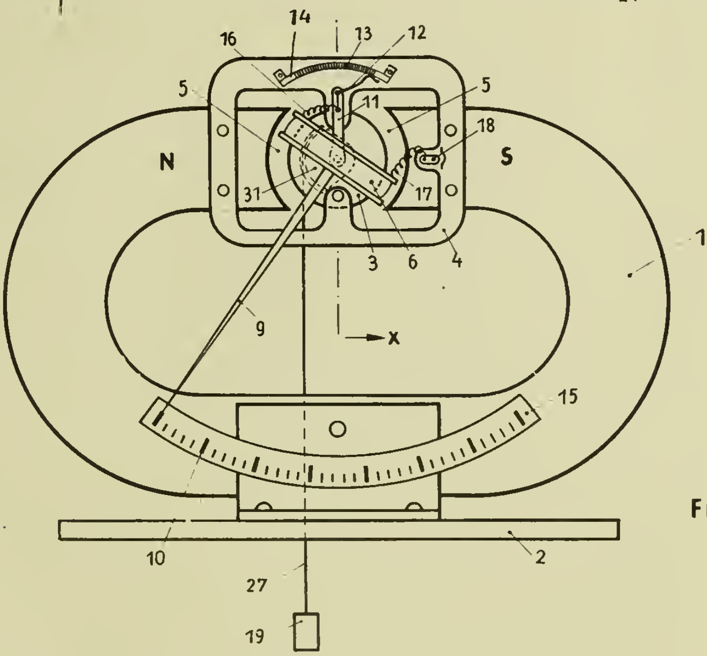

Fig.2

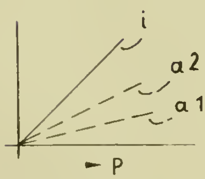

Fig.4

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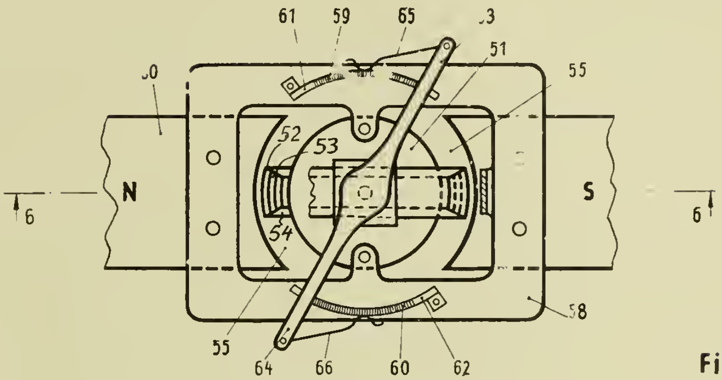

Fig. 5

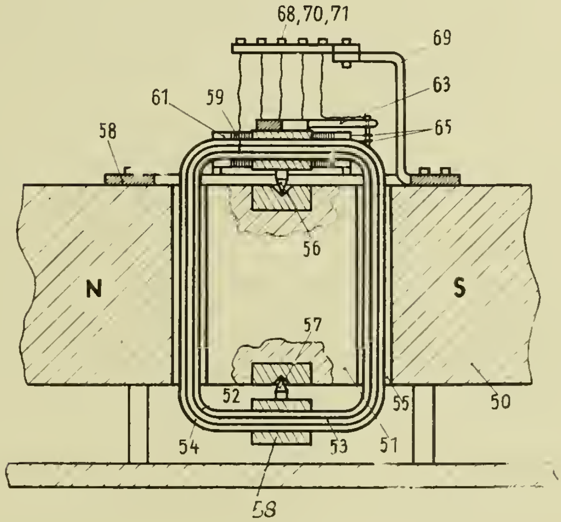

Fig. 6

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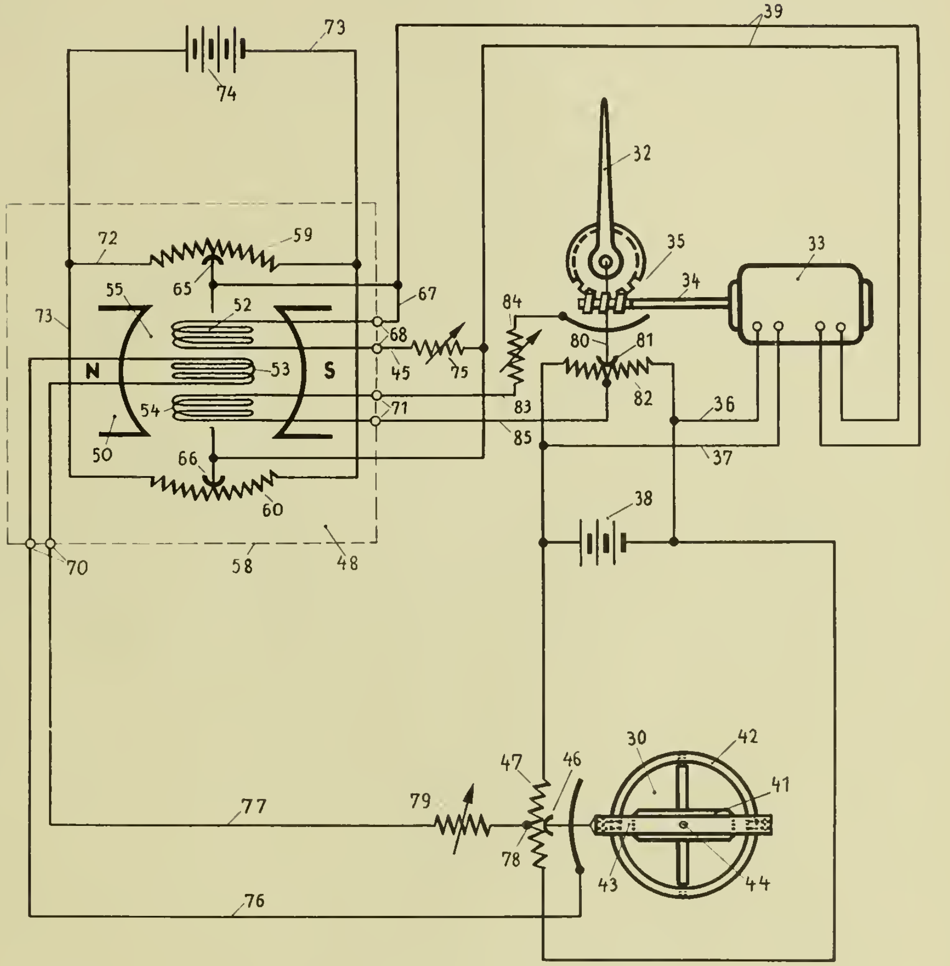

Fig. 7

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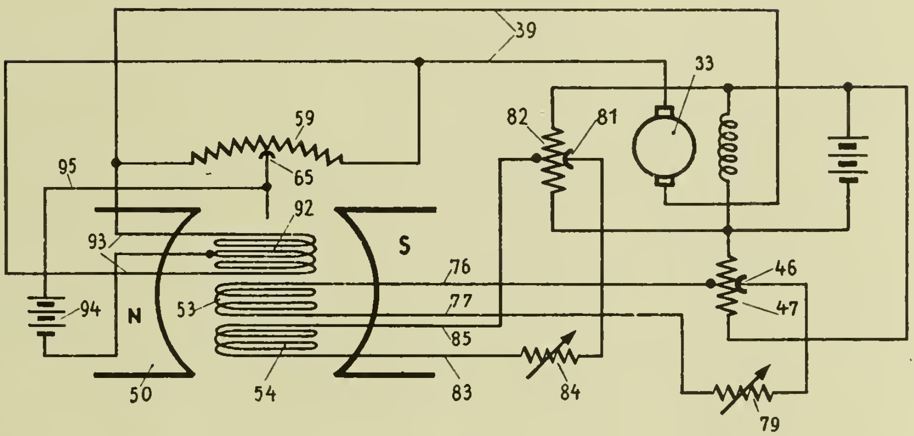

Fig. 8

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